THE

AGRICULTURAL BULLETIN

OF THE

FEDERATED MALAY STATES.

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EDITORIAL NOTES.

Staff Appointments and Changes.

Mr. J. H. Dennett, reported his arrival on 5th July and assumed duties as Assistant Agricultural Chemist.

Mr. H. W. Jack, Economic Botanist, reported his return from leave on 8th September.

Mr. E. Farquharson, reported his arrival on 20th September and assumed duties as Assistant Agriculturist.

New Uses for Rubber.

Chiefly owing to the present slump in the price of raw rubber much has been written lately in regard to new uses for rubber and many suggestions have been put forward.

The prize competition held in 1920 under the auspices of the Rubber Growers' Association, the results of which have been published recently, may be mentioned in this connection.

In very few cases, however, have the suggestions put forward included anything of a very novel character or of great value. Even in connection with the many suggestions put forward in the Rubber Growers' Association competition, a recent article in the *India Rubber World*, shows that many of these suggestions are not new and that quite a number have been patented previously and lost sight of.

New uses for rubber however, as pointed out recently in the *India Rubber Journal*, are of no value, unless accompanied by orders and the principal trouble recently has been the lack of demand even for old and well established lines of goods, while new articles take long to become established.

While suggestions for new uses of rubber should not be neglected and the value of propaganda and advertisement should be realized, the future of the rubber industry depends, in the writer's opinion, to a very great extent on increased motor transport, since in this industry the rubber is largely destroyed, creating a continual fresh demand.

Whatever opinions may be held also as to the prices of manufactured rubber goods, compared with the price of the raw material, it is significant that a number of the well-known rubber manufacturing firms in Great Britain show losses for the last year.

All suggestions for an increase in the proportion of rubber in manufactured rubber goods are of little value, unless the price becomes stabilised. It cannot be expected that the manufacturer will alter his methods of manufacture to include more raw rubber, unless the price of the raw material remains reasonable.

Further such recommendations would appear to suggest that the rubber manufacturer is not acquainted with his work and that substances other than rubber are included in various articles, in order to cheapen the price, and that at the same time an inferior article is produced. This suggestion is far from the truth, as far as all the well-known rubber manufacturing firms are concerned, since no combine exists and there must be keen competition, which would prevent this. Probably owing largely to the former high prices ruling for raw rubber, the reclaiming of waste manufactured rubber has assumed large proportions and the inclusion of reclaimed rubber in various new articles is now fairly extensive and not likely to decrease, now that its value has been realized and its price to the manufacturer at the present time is probably on a par with the present price of raw rubber.

The editor holds no brief for the rubber manufacturer, but for our own good as producers or as being interested primarily in the production of the raw material, it is as well perhaps to be reminded of certain facts. The suggestion brought forward for the inauguration of a large rubber manufactory working in co-operation with the plantation industry is essentially only a question of certain estates, or say all estates in a large combine such as the Rubber Growers' Association, establishing a new business in which the combine hopes apparently to make up on the roundabouts what it loses on the swings. It is difficult to see what other object will be attained, since the only way to absorb our present output is to obtain an increased demand for rubber goods and this will not be obtained merely by erecting another factory to manufacture more goods.

A reference might also be made to the substitution of raw rubber for manufactured rubber in the making of certain articles.

One drawback to the direct use of raw rubber articles in say Europe or America is the fact that in the winter a piece of raw rubber becomes almost as stiff and hard as a board. The impetus given to the use and application of rubber in the early days was due entirely to the discovery of vulcanization, which renders the material much less liable to atmospheric condition, light, heat, and changes of temperature and also increases its elasticity and strength. Rubber undoubtedly has its uses in the raw state, but these are limited. If the average Britisher—man or woman—and other Europeans used goloshes to the extent of our American cousins, this would absorb a considerable quantity of rubber. The Britisher generally however appears to be averse to these articles. It is doubtful whether the slump or ruin of the plantation rubber industry will cause their universal adoption.

AGRICULTURAL SHOWS.

A series of district agricultural shows embracing all the districts of Pahang has recently been organized and carried through. Great interest has been shown throughout by the natives—especially Malays. The shows were as follows: 20th August, Kuantan; 3rd September, Pekan, where there were nearly 2,000 exhibits; 17th September, Temerloh, containing 862 entries in the classes for padi and rice; 17th September, Raub, with 1,500 entries throughout the classes; 1st October at Kuala Lipis where the show attracted 2,500 exhibits.

In all the above shows, cereals have taken first place in importance, and an officer of the Agricultural Department attended to assist in the judging of these classes and also to help in the general arrangements of the shows.

The Kuala Lipis show is worthy of particular mention. This is the first show that has been held at this centre; and notwithstanding the rapidity with which the arrangements had to be made, the exhibits were not only numerous, but the majority of them were of very good quality. At this show there was a class for Malay-made grass ("Mengkuang") mats, which attracted 180 exhibits, many of them of very fine workmanship and striking design.

The Agricultural Department sent to each of the above shows, with the exception of Temerloh, a collection of fibres, oils and crops of importance. This collection, which is being improved upon for each succeeding show, has attracted great interest amongst visitors to the shows, and its educational value is undoubted.

We would congratulate Pahang on these shows, and express a hope that they may become annual events.

MANILA HEMP.—(Musa textilis).

Many enquiries have been received regarding the cultivation of Manila hemp and supplies of planting material. Manila hemp is propagated either by means of root cuttings, or more commonly from suckers which arise at the base of the parent plant; it is also sometimes grown from seed.

An estimate of the approximate cost of exporting suckers from Manila to Singapore has been obtained from the Bureau of Agriculture, Manila, together with addresses from which planting material can be obtained. Judging by the departmental experimental plots this plant seems well suited for cultivation in Malaya.

BOWSTRING HEMP.—(Sansevieria Zeylanica).

A sample of this hemp grown locally and prepared by the Agricultural Department has been despatched to Europe for report. This crop requires partial shade throughout its period of growth and appears to do well under the shade of old rubber. This is of special interest as it may prove a useful crop in old rubber clearings; thinned-out areas would probably give the necessary shade.

PESTS AND DISEASES.

Several papers have recently been issued on the subject of brown bast. It is proposed in the near future to publish a resumé of the work of the Brown Bast Investigation Committee. Much of the work reported from Java has been paralleled in Malaya and it will be advantageous to have the two sets of results side by side.

Enquiries concerning padi pests have been numerous and in order to obtain fuller information regarding some of the borers, a special officer has been stationed in the Krian district.

Recent observations indicate that at the present time the principal "borer" is a *Diatraea* species and not *Schoenobius bipunctifer* as formerly supposed.

There is no doubt that, until the cultivators of padi have been educated to the necessity of clean culture, padi pests will always be prevalent. In particular the practice of allowing stubble to remain on the ground until next padi season renders the succeeding crop especially liable to attack.

Erratum.—Agricultural Bulletin Vol. IX, No. 2, page 101, line 4 from bottom, for "60 per cent of kernels *read*" 60 per cent of pericarp=60 lbs. pericarp per palm per annum.

COVER CROPS AND CLEAN WEEDING.

THE BUTTERFLY PEA (*Centrosema Plumieri*), AND GIANT MIMOSA (*Mimosa Invisa*).

By F. G. Spring.

OWING to the numerous enquiries received, for some time past, regarding cover crops, particularly in respect of planting methods, the following notes on suitable covers may be of assistance to prospective growers. Before it is possible to make recommendations regarding cover crops generally it is necessary to know for what purpose they are required. The word "cover" would naturally imply that shade, for retarding the growth of weeds, is the only object of the crop but they are now commonly used as a means of preventing soil wash and in the case of leguminous crops to add nitrogen to the soil. Some plants will fulfil all purposes satisfactorily and this is unquestionably the type to be cultivated on undulating or hilly land. Cover crops are frequently associated with green manures and although the former will also perform the objects of the latter, green manuring is done principally for incorporating organic matter in the soil so as to improve its physical condition.

The growing of cover crops in young rubber areas is, at present, receiving more attention in Malaya than it ever has done in the past. With plantation rubber around 8*d*. per lb. the expense incurred in clean weeding is a very heavy item, particularly on those estates with large immature areas; companies with limited capital would be wise to consider the question of establishing suitable cover crops, especially if there is any prospect of ultimately resorting to their adoption through lack of funds to continue clean weeding. To carry on weeding now and afterwards to abandon it is purely waste of capital. Clean weeding is so generally popular throughout the country and has been adhered to so long that one naturally hesitates to advocate a complete change in this direction. Common arguments against the growing of cover crops are (*a*) slow rate of growth of the young rubber trees, (*b*) difficulties of detecting harmful weeds such as lalang, (*c*) high cost of weeding when lalang does appear, (*d*) spread of root disease and difficulties of inspection work. In some cases the growth of the young trees may possibly be slightly backward in areas where cover crops are grown but this is generally due to cultivating the wrong class of cover and to the presence of objectionable weeds. There is no evidence, however,

that trees, slow in growth, are poor yielders, in fact they may prove the reverse. The difficulties of detecting harmful weeds are great when tall growing covers such as *Tephrosia candida*, *Tephrosia purpurea*, Indigo, *Crotalaria striata* or other such crops are grown as permanent covers on the land but these crops serve a useful purpose when cultivated for a short period and then turned in as green manures. A suitable permanent cover should provide heavy shade on the surface but should not be tall growing or woody in habit. Undoubtedly the cost of weeding is high when lallang does appear in cover crops and for this reason a most careful selection of the cover should be made in order that it will thrive on the land and thus provide the maximum shade with the minimum risk of lalang becoming established on the area. Regarding the question of disease I have discussed the matter with the Government Mycologist and he is of opinion that in areas free from diseased timber the danger of the spread of fungus diseases will not be influenced by the covering of the ground. On the other hand on areas with decaying timber (not clean cleared) there would b the possibility of increasing danger to be expected from the spread of diseases. With regard to *Fomes*, whether in cleared or uncleared areas, it would be more difficult to treat the disease. Bad attacks of *Fomes* are purely local and in the majority of cases this need not interfere with the general question.

One of the most important factors which commends the cultivation of covers, at least on hilly and undulating ground, is the prevention of surface wash. The damage which has been done, and is being done, by soil wash, can hardly be over estimated. The top layers of the ground are the most valuable agriculturally and when they are lost the fertility of the land is greatly reduced; this would be most evident if annual crops were grown in place of rubber, and it is fortunate that the rubber tree is comparatively such a hardy one. To endeavour to replace the fertility of soils which have suffered from soil wash, "green" and artificial manuring would have to be resorted to and it is extremely doubtful whether this would compensate unless perhaps manuring were continued over a long period. It is not intended to infer from this that covers are the only means of preventing soil wash, but this subject is to be dealt with in a future article. One cannot place too much importance on the subject of soil wash and plants which will remedy this can be safely recommended for cultivation on hilly or undulating ground. Unfortunately most covers are failures on land which has been badly washed; it is essential therefore to establish the cover in the early stages of development of the estate in order that the rich top soil which is necessary for the proper growth of the crop, may be still present.

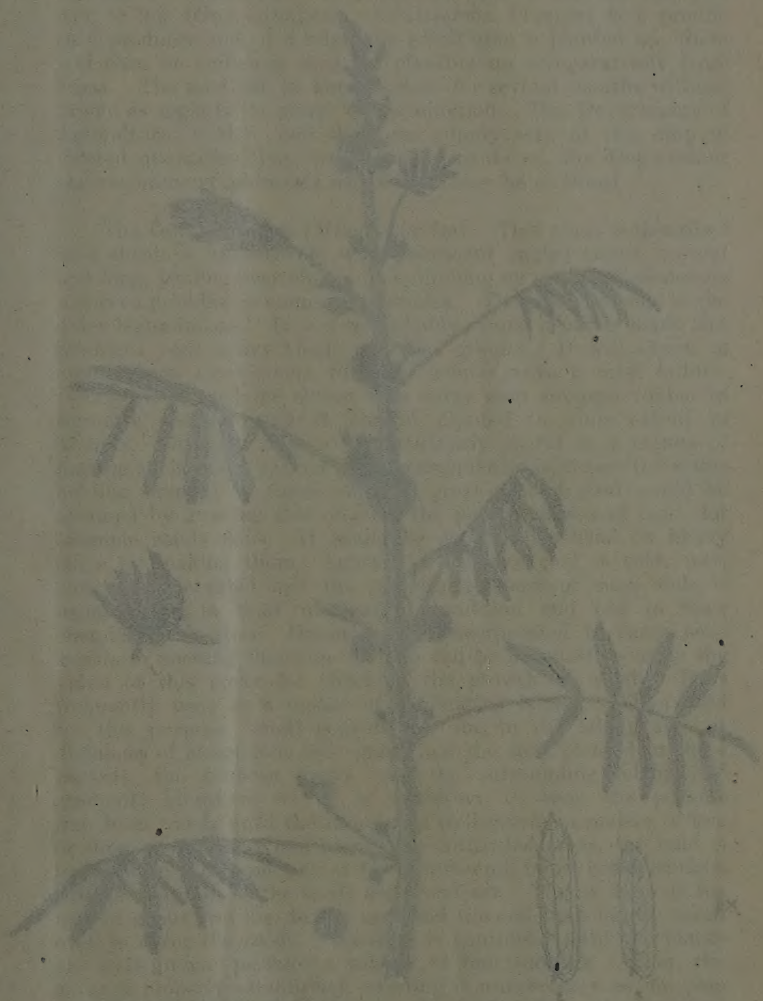
Some planters argue that cover plants impoverish the land, but this is a mistaken idea. When the residue of plants, other than those belonging to the order leguminosae, is incorporated in the soil, the material which has been taken from the land is

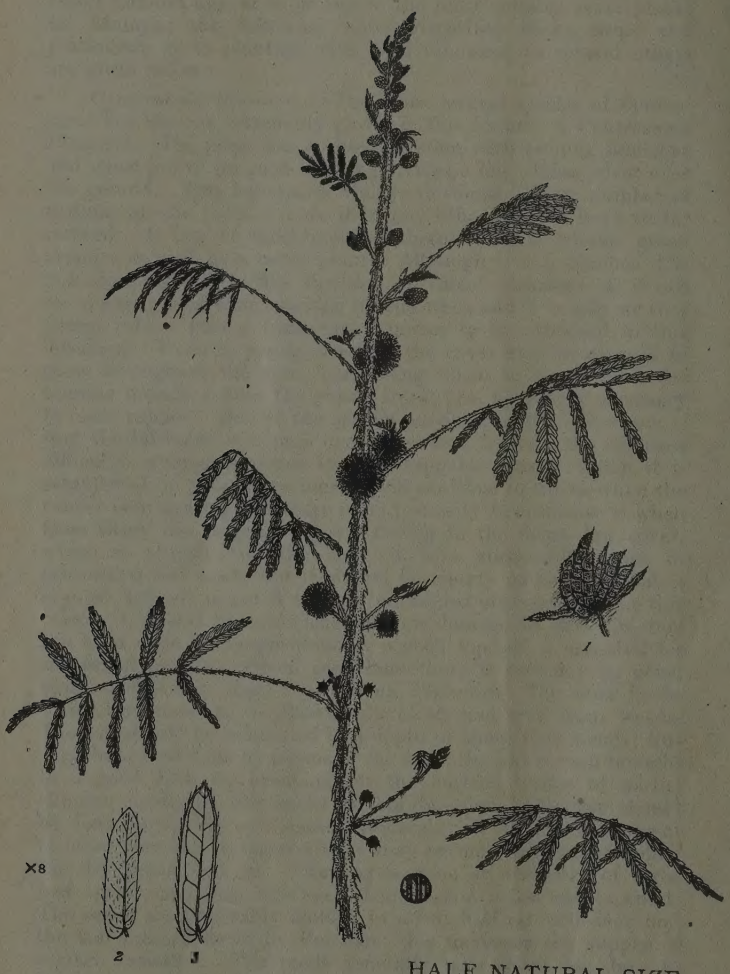
returned to it, but with leguminous crops this material is not only returned but it is possible to increase the actual amount of nitrogen in the upper layers of the soil. It is commonly found here that legumes may not show nodules for a time but although they may not appear in the first annual crop or for a time in perennials, the plants, as a rule, ultimately show the characteristic nodules. When there is a plentiful supply of nitrogen in the soil the legumes will not always form tubercles but will obtain their nitrogen requirements from the ground. Lime stimulates the action of the bacteria present in the nodules and a small application of lime applied to the land, before growing the first crop of legumes, is extremely beneficial. An additional advantage in growing a cover crop is that the plant takes up part of the elements as they become available in the soil which might otherwise be lost in drainage. It is evident that the cover chosen should be selected preferably from the order leguminosae. The turning under of green material increases the power of light soils for holding water and on the other hand has an equally beneficial action in opening up heavy soils or in other words, green matter added to the land tends to establish a physical or mechanical equilibrium suitable for the growth of cultivated crops generally.

In young clearings no difficulty is experienced in establishing a cover, provided the top soil is even moderately rich but in badly washed areas it is a different proposition. When silt pits have been dug they may be made use of for the purpose of starting the crop and provided the soil in these pits is of good quality the cover may gradually extend over the land. In areas which have suffered from erosion it is very hard to establish cover plants and it is necessary to prepare the spot thoroughly for the reception of the seed in order that the young seedlings may have some chance of development. The Giant mimosa, which is a very hardy creeper, will perhaps thrive better under poor soil conditions than any other cover known locally. A common practice in Sumatra for establishing Giant mimosa on land which has suffered from soil wash, is to construct a low furrow, in contour, and to apply a handful of well rotted cow manure at the position where the seeds are to be sown in the furrow. In old clearings it is very hard to establish cover crops on account of the shade produced with the average distance of planting, but the cost of weeding densely shaded areas is relatively small, when rubber is fetching a fair price. Unfortunately it constitutes a considerable item of the expenditure with the price of rubber around 8*d*. a lb. Some covers, e.g., *Centrosema Plumieri* will continue to thrive under comparatively heavy shade, provided they have been established in the first few years of the development of the estate. The Giant mimosa appears to be one of the most likely covers to prove successful for planting up areas under relatively heavy shade. The first four years in the history of a rubber estate is the most suitable time for improving the land, by means of incorporating green manure in the soil and it is unfortunate that more advantage is not taken of this period to improve the

mechanical condition of the soil. *Centrosema Plumieri* and the Giant mimosa appear to be two of the most suitable cover plants for Malaya; the following notes regarding these crops and particulars as to planting with brief reference to several others are given below:

Centrosema Plumieri:—There are several species of *Centrosema* but the one commonly grown in this country is *Centrosema Plumieri*. The plant has a climbing stem with twining branches and when grown on good land it provides a low, dense cover over the ground. This legume in Malaya develops a large number of nodules on the roots,—more than any other plant I have so far noticed. It can be recommended therefore as a suitable green manure as well as a cover plant. Although it is a climber it is not objectionable, in this direction, in rubber clearings, as it can be so easily kept from growing up the trees and it is only in very young rubber that a little care requires to be exercised in this direction. Even in young clearings the cover may be allowed to grow throughout the area, care being taken to throw back the twining branches from the young trees; this is seldom necessary in older rubber. One of the special advantages of *Centrosema* is that the labourers can pass over this cover without the slightest difficulty or inconvenience even in tappable areas. When it is established, in young clearings, it will continue to thrive when the rubber is in bearing and there is no necessity to eradicate it when trees reach the tappable stage. Owing to the dense low cover, which it provides on the land, it is a successful means of preventing soil wash, but it should be clearly understood that it is most difficult to get it to grow on eroded surfaces and for this reason it should be established before damage in this direction has been done, as unquestionably a good top soil is essential for successful growth. Given good land there is probably no cover more satisfactory than *Centrosema Plumieri*. The area to be planted requires to be thoroughly clean and free from weeds. The soil should be cultivated to a depth of about four inches; this is perhaps best done by means of the fork; the soil is then brought to a good tilth by breaking up the surface lumps of earth; climatic conditions also assist in this direction. Planting should be done during the wet season, preferably at its commencement in order that the young seedlings may become established before the dry period sets in. Planting is done at distances of three feet apart, each way, two seeds being sown, a few inches apart. The seeds are preferably dibbled in about half an inch deep and the soil pressed down by the foot; this increases the supply of surface moisture. The seeds generally take about ten days to germinate. About four lbs. of seed are required per acre for planting purposes. Weeding must be well attended to during the first four months of growth; subsequent weeding is unnecessary as the plant under good soil conditions provides sufficient shade to retard the growth of weeds. It is advisable, however, to make periodical inspections, in case lalang might appear and in the event of its doing so, a gang of coolies should go carefully over the land and eradicate this noxious weed; there is little trouble, however, in this direction when the plant is cultivated under





Mimosa invisa, Mart. Giant Mimosa.

(1) Seed pods.

(2) Average form of leaflet of M.invisa.

(3) Average form of leaflet of M.pudica, (Sensitive Plant)

suitable soil conditions. It is reported that it does not thrive in wet or low lying situations. *Centrosema Plumieri* is a prolific seed producer and, if a relatively small area is planted up, there will soon be sufficient seed for planting up comparatively large areas. The seed can be kept in store for several months without injury as regards its power of germination. The Department of Agriculture, F.M.S. and S.S. can supply seed of this crop in limited quantities, but, when unable to do so, the Department can recommend addresses where seed may be obtained.

The Giant Mimosa (*Mimosa invisa*). This plant is described as a shrub or undershrub, with pubescent angled stems, several feet long, trailing over bushes and climbing by means of numerous recurved prickles on stems and petioles. The plant belongs to the order leguminosae. It is a remarkably strong growing plant and produces very heavy shade over the ground. It will thrive in areas where *Centrosema Plumieri* would prove a total failure. It is grown to a large extent as a cover crop amongst rubber in Sumatra and is being at present planted to some extent in Malaya. On light soils it is particularly useful as a means of making such land "heavier" and consequently increases the water holding capacity of these soils. A great deal of good would be attained by growing this crop on the poorer classes of land, for example sandy soils. It would be equally beneficial on heavy clays by making them "lighter." A heavy clay is cold, wet, and poorly aerated and the unproductiveness of such soils is usually due to their mechanical condition and not to their chemical properties. Green matter incorporated in these soils assists in opening them up. There can be no question as to the value of this cover for checking the growth of weeds. It is frequently used as a means of eradicating lalang. When used for this purpose, small pockets are dug in the lalang area at distances of about four feet apart, and the seed planted in these pockets, the mimosa grows over the surrounding lalang and gradually smothers it. It is necessary to keep the pockets free from weeds until the mimosa is well grown, a matter of two or three months. When planted in cultivated areas, the land is prepared in the same way as for Centrosema but a better surface tilth is required, as the seeds are broadcast. This is done at the rate of about two lbs. to the acre and the soil then lightly raked over to cover the seeds. Weeding is continued until the plants are well grown, perhaps a matter of four months. When the cover is properly established, weeding is unnecessary as the crop provides a permanent cover over the land. The only attention necessary is to see that it does not grow too thick around the trees. The chief objection to this cover is the spines or prickles, which it develops, rendering it difficult for labourers to work. With rubber in bearing, strip weeding would be necessary to facilitate tapping.

In Sumatra, the cover is kept low by means of beating it periodically with sticks. The cover is effective as regards prevention of soil wash. I have already referred to the means by

which it is established on land which has suffered from soil wash. This Department can only supply seed for experimental purposes and if planting material is required in quantity, it is recommended to procure the seed from Java; an address can be given to applicants.

The Sarawak Bean (*Dolichos Hosei*), a native of Sarawak, has proved useful on certain classes of land; like *Centrosema* it requiries good soil conditions. On light clays, and soils with a good proportion of humus, it does extremely well. It is a low growing leguminous creeper providing a thick cover on suitable land. It is frequently grown amongst coconuts, and in this class of land it thrives well. The Sarawak Bean is always propagated from cuttings which are planted at distances of three feet, weeding being carefully attended to for the first four months. Before this cover is grown on a large scale, on any estate, it is recommended experimentally first, to ascertain whether the soil is suitable for its development.

The Horse Gram (*Dolichos biflorus*), has proved to be a useful green manure, but it is not recommended as a cover crop, as it occupies the land for a few months only. When required as a green manure, the seed is broadcast at the rate of about 10 lbs. to the acre on a well prepared surface and turned in when from three to four months old, before it commences to die off.

There are many other leguminous creepers which have been introduced into this country and many of them are most useful green manures, but their utility as suitable permanent cover crops is extremely questionable.

It is not proposed in this article to deal with the tall growing cover plants; these may be dealt with in a future article.

CHEMICAL NOTES.

Rubber From Individual Trees.

INVESTIGATION on the rubber from latex collected from seven trees, over a period of three months, has shown that variation in the physical properties of the rubber from different trees is probably not as great as the variations which occur from week to week in rubber from the same tree. The investigations are not yet sufficiently advanced to permit of definite conclusions being drawn.

Rubber Road Paving Blocks.

Rubber paving blocks manufactured locally in connection with Mr. Caulfield's invention of rubber blocks attached to concrete blocks, by means of expanded metal embedded in the rubber slabs, have been examined. A number of rubber blocks made from different experimental mixes prepared at the Department of Agriculture has resulted in the preparation of a suitable block which is considered to be superior in wearing qualities to the sample submitted to the department for tests. The details of the mixings have been embodied in a specification sent to Messrs. Mace Hall and Co., for the purpose of manufacturing such blocks.

Coconut Investigations.

A number of individual coconuts have been and are still under investigation to ascertain the variation in quality of the nuts, in respect of yield of copra and oil. The investigation has included the examination of semi-tall, tall and dwarf varieties. It has been shown that it would not be profitable to prepare alcohol from the waste "milk" from ripe coconuts since the sugar content of the milk is less than one per cent. There appears to be no definite relationship between the diameter or circumference of the nuts and the copra content, nor between the volume of the nut and the volume of the kernel.

The percentage of oil in the nut appears to reach a maximum when the embryo weighs from 80 to 100 gramms. The husk is not considered to be of any value for distillation purposes, nor for the manufacture of coarse paper, owing to the difficulty of softening the fibres.

The shell when subjected to destructive distillation yields a liquid distillate and a quantity of inflammable gas, the properties and qualities of these require further investigation. As is probably known, the charcoal from the shell is a valuable absorbent of gases and was utilized in gas works during the war.

Vegetable Oils.

Ten samples of different vegetable oils from local products were prepared and exhibited at the Malay Agricultural Officers' Conference, to illustrate a paper on "Some Plant Oils of Malaya" The samples are being retained for exhibition purposes at District agricultural Shows and to form the nucleus of a museum of local agricultural products. Samples are also being sent to the Imperial Institute for exhibition and to the Malay States Information Agency for valuation.

Oil From Centrosema Plumieri.

An investigation of the seed of Centrosema plumieri has shown that the oil content of this seed is only 1.25 per cent. and therefore of no value commercially.

Castor Oil.

Several analyses of different varieties of Castor oil seeds have been carried out, including a number from an estate in which the oil is manufactured on a commercial scale. A report on these investigations will be published in a future issue of the bulletin.

Investigation has also been made on the efficiency of the hydraulic oil expression machinery on an estate.

Rubber Seed Oil.

In connection with an enquiry for rubber-seed oil, a sample of oil from fresh seed was prepared, the acidity of the sample calculated as oleic acid was only 0.6 per cent.

Candle Nut Oil.

An investigation on the most satisfactory method of cracking the candle nut (Aleurites moluccana) to enable the kernel to be extracted, has been carried out. A satisfactory method was found to be dry heating at a temperature of over 100°C. followed by rapid chilling in cold water and soaking for several hours.

In two experiments, 96 per cent. and 94 per cent. of nuts were cracked by this method and the kernel could be easily extracted. The oil is not affected by the treatment.

Essential Oils.

Investigations on Citronella oil have been continued and a consignment of two gallons forwarded to the Malay States Information Agency for valuation and sale. Examination of Citronella grass grown at varying altitudes is in progress.

Soil Investigations.

A soil survey of an area at Pondok Tanjong has been made and the conclusion reached that the area is suitable for padi cultivation. A large number of analyses of soil samples is in progress.

Peat Distillation.

Reports have been submitted to estates in connection with the utilization of peat deposits. The investigations show that the gas produced by the peat in producers is of value. Further work is in progress.

Miscellaneous Investigations.

An examination of tapioca and a sample of local guano indicated that the samples were of no value as fertilisers. Ashes from attap and coconut husks were also shown to have little manurial value.

Fibres.

Several samples of fibres have been examined and found to be of excellent quality.

REVIEW.

TABLES OF REFRACTIVE INDICES.

Vol. II.—Oils, Fats and Waxes.

Compiled by R. Kanthack, edited by J. N. Goldsmith, Ph. D., M. Sc., F. I. C.

Publishers.—Adam Hilger, Ltd., London, 1920, pages 295, including appendices.

Price 25/- net, containing over 2,500 measurements on over 500 oils, fats and waxes.

THE refractive index of many substances, particularly of essential and fixed oils, fats and waxes is frequently a valuable physical characteristic, which enables the purity of a particular compound or mixture of chemical compounds, found in animal and vegetable products of fairly constant character, such as oils and fats, to be determined rapidly.

It enables the chemist frequently to classify and identify substances and to detect adulteration. During recent years, owing to the improvement in and adaptation of the instrument known as the refractometer, used for the rapid determination of this index, the application of this instrument has been widely extended in chemical investigations.

The book under review, which contains a mass of valuable information and data has been published by Messrs. Adam Hilger, the well known manufacturers of the Hilger Refractometer and of other scientific instruments employed in the determination of other physical characteristics of chemical compounds.

In addition, the book contains a useful bibliography, details on the "Dispersion" of oils, and refractive indices of the important glycerides and free fatty acids found in animal and vegetable fats and oils and of the hydrogenated (hardened) oils.

The oils and fats are arranged in alphabetical order, the tables are printed in an excellent manner and the pages interspersed with blank pages for notes. Information is also given on the animal or vegetable origin of the oils, fats and waxes.

The book should be of great value to chemists, who are concerned with investigations in this branch of chemistry. Much credit is due to the publishers, author and editor for this valuable compilation.

B. J. E.

IPECACUANHA.

Alkaloidal Content of Leaves and Stems.

AT the request of Dr. T. A. Henry, D. Sc., Director of the Wellcome Research Laboratories, London, a sample of leaves and stems of the Ipecacuanha plant, was obtained through the courtesy of Messrs. Barlow and Co., and sent to the Wellcome Research Laboratories for investigation of the alkaloidal content and particularly the emetine content of this material.

Results of Analyses—Dr. Henry reports that the sample of leaves and stems were found to contain 1.5 per cent. of alkaloids, soluble in ether, of which 0.45 per cent. were emetine.

Ipecacuanha roots of good quality contain 2 to 2½ per cent. of alkaloids, soluble in ether, of which from half to three-fourths is emetine.

Dr. Henry states that it is interesting to have established that the leaves contain emetine, since there is nothing on record on this point.

As is well known, the roots constitute the commercial drug. It is considered however that the collection of leaves might be injurious to the plants and therefore the leaves will be of no importance as a source of emetine.

It would however seem desirable that the effect on the plant of collecting the leaves should be investigated. (Ref. No. D. A. 324/21).

B. J. E.

NOTES ON THE "SOUTH AMERICAN LEAF DISEASE" OF RUBBER.

By W. N. C. Belgrave.

MYCOLOGISTS have repeatedly pointed out the serious results which might follow widespread attacks of leaf diseases of rubber. While plantations in Malaya have been, so far, happily free from such troubles, reports received in 1918 and 1919 of extensive damage to South American plantations made it desirable that an officer of the department should visit and become familiar with the disease, thus ensuring recognition at the earliest possible moment should a local outbreak occur.

The writer visited Trinidad and British Guiana in November, 1920, and the following notes are taken from the report submitted to Government giving the results of that visit.

History of the Disease.

The first mention of the disease as such is to be found (*a*) in the Journal of the Board of Agriculture, B. G. Vol. VI, No. 3, January 1913, and is a review of a paper by Kuijper in Bulletin No. 28, 1912, of the Surinam Department (Dept. v. h. Landbouw) in which the trouble is attributed to *Fusicladium Macrosporium*. The disease is said to attack only weak trees and to be, on the whole, not serious. Young leaves are attacked, and infected trees may be found on plantations all over Surinam, even those in virgin forests 38 miles from the Coast. The native wild rubber *Hevea guyanensis* is also attacked and six year old trees have been killed. The fungus is difficult to grow in artificial culture.

(*b*) In July, 1913, Bancroft (*ibid* VII., 1) states that a fungus apparently of a new species has recently been recorded in the Colony on nursery beds, and points out the necessity for destruction of diseased material before planting out; he recommends lime sulphur spraying. The fungus was subsequently identified by Massee as *Passalora heveae*.

(*c*) That the disease was not seriously regarded may be gathered from a minute by the then Governor, Sir Walter Egerton, reprinted in J. Bd. Agric. IX., 1 November, 1915. Drawing on his Eastern experience, His Excellency predicted a healthy future for the industry in British Guiana and anticipated no trouble from disease.

(*d*) By the middle of 1916 the situation had changed for the worse and Bancroft published a long article in the Official *Gazette* No. 228. He states that cultivated Para rubber was first imported in 1895 from Kew, in 1896-'99 from Trinidad, and for the past seven years annually from Singapore. Importations have also been made by private individuals from Ceylon, Trinidad and Dutch Guiana. The area under cultivation (1916) is 4,687 acres of which 1,155 acres was on coast land, 2,854 on the banks of the Demerara and Essequibo rivers and 678 in the N.W. and Pomeroon districts. The soils vary from heavy clay, through medium loams with loose surface and much

organic matter to undulating laterite further inland. In a brief review of previous literature Bancroft notes that in 1904 Hennings described three rubber leaf fungi in Brazil: *Dothidella Ulei, Aposphaeria Ulei and Phyllachora Huberi.*

In 1908 an undescribed leaf disease was reported in Surinam, and in 1909 a leaf disease, the symptoms of which resembled those of the present disease, occurred in British Guiana on trees from Singapore seed. These trees recovered but were again attacked in 1911, when the Economic Biologist got infections to healthy trees. In 1913 the present disease was seen on this plantation by Bancroft and has been present ever since.

Closely similar to the leaf disease of Dutch Guiana and the Brazilian *Aposphaeria*, the British Guiana disease has at the time of writing (1916) spread over the whole Colony except the Essequibo Coast and the greater part of the Demarara Coast. There is no record of the disease on the 30,000-50,000 plants in the Georgetown Gardens. (Most of these are seedlings. The Gardens are in the Coastal area W.N.C.B.)

Trees six years old and 50 miles from any other Hevea plants have been attacked. Die-back (Diplodia) is believed to cause much secondary damage. The mycelium of the fungus is confined to limited area below the points of infection, and attempts to grow it in artificial media have failed. The disease is more prevalent the larger the area under cultivation and the more humid the atmosphere. The apparent lack of connection between heavy rainfall and prevalence may be due to the possible discrepancy between recorded total rainfall and high humidity. In the N. W. district during a recent prolonged drought the disease was worse, while on the Mazaruni it is now more prevalent in wet weather. The disease has been found on *Hevea confusa* and *H. guyanensis* and on no other wild plant. Spraying when leaves are $1\frac{1}{2}$-$2\frac{1}{2}$" long is suggested, also burning of fallen leaves and destruction of wild *Hevea* plants.

(*e*) In the Official *Gazette* No. 2 of 20th January, 1917 Bancroft gives an account of a visit to Surinam. He states that the disease is rampant and much more serious there than in British Guiana though climatic conditions are very similar. The total area under cultivation is about 2,400 acres mostly interplanted. When first noted the disease as in British Guiana was sporadic and did not appear likely to become epidemic till 1914. The majority of plantations are badly affected and trees of all ages are attacked and dying, in some cases losses of one-third the total planted have been sustained. The fungus is a native of Peru, Brazil, Guiana and probably Trinidad, and attacks always start sporadically on plantations. In view of the proved travelling powers of spores, destruction of wild Heveas entailing as it does great expense, can no longer be advocated, and spraying has not proved to be effective. Suggestions for the simultaneous defoliation of large areas by 'smoking' or 'gassing' are made.

(*f*) A full description of the fungus and its method of attack has been given by Stahel in Bull No. 34, January 1907, Dept. v.d. Landbouw in Surinam in which the fungus is named *Melanopsammopsis Ulei* n. gen. (A translation of this paper is available in the Mycological Library, Department of Agriculture.

Personal Observations and Present Position of the Disease, Trinidad.

In Trinidad the disease was found in a flourishing condition on a nursery bed of 5-7 months old seedlings. The bed was in good condition, not overcrowded, and well supplied with water. Nearly every plant was attacked and almost all the original stem tips had broken off, the attack starting on very young just opened leaves and gradually involving the stem tip.

The attack may cause wrinkling of the margin or spotting of the leaflets, in the former case death and leaf-fall soon follow, in the latter the leaflet may survive. The spots are at first dark on the light transparent background of the leaflet, becoming later light on the dark green ground, still later the diseased patches fall out, giving the leaflets a shot-riddled appearance.

Conidia are produced only in the early stage of attack, followed later by pycnospores and ascospores produced in stromata which form black star-shaped pustules on the older leaves, giving these a most characteristic appearance, difficult to figure or describe adequately but quite unmistakable once seen. The writer has never seen anything even distantly resembling this disease in the Federated Malay States.

Close to the diseased nursery bed in the Gardens was a field of very badly grown old rubber with signs of considerable over-tapping in the past. None of these trees showed signs of attack. The Acting Director of Agriculture informed me that he had seen the disease on a plantation and in one case on untapped trees.

British Guiana.

No recently attacked leaves were seen in British Guiana. This freedom from the disease was apparently due to a prolonged dry spell. The shot-hole appearance of attacked leaves was noted and considerable information of a practical nature gathered.

Aspects of the Disease Affecting the Federated Malay States.

The incidence of South American leaf disease is governed by the following facts (*a*) only one of the three spore forms—the conidial—is capable of reproducing the fungus.

(*b*) The conidia are short lived, possessing no power of resistance;

(*c*) The fungus is, as far as is known, a pure parasite;

(*d*) Infection can only take place on very young leaves.

There must therefore be an almost continuous supply of fresh young leaves for the disease to flourish. It happens to be the case in Guiana (and presumably throughout South America) that wintering is not sharply defined as in the Federated Malay States but is spread out over the whole year. Only in abnormal years such as 1920, does a drought cause nearly simultaneous wintering, following which the disease is much reduced, as noted above.

It seems highly improbable that the fungus with its non viable spores could ever be accidentally introduced into the East, or that if introduced it could do any appreciable damage owing to our sharp wintering season, *provided the life-history remained unaltered.* There is, however no certainty that such alteration would not occur as a result of changed conditions, and should, say the ascospores become functional and be enabled to tide the fungus over unfavourable seasons irreparable damage might be done. It is therefore, suggested that the present quarantine restrictions on import of rubber 'plants' be extended to include the whole of the Western rubber growing area.[1]

Immunity.

The much greater damage done by the disease on plantations as compared with jungle trees is believed by some authorities to be due to the fact that the present sparsely distributed wild Heveas in South America represent a small immune or partially immune band of survivors from a much larger original population. Others attribute the difference to mass infection on plantations, and this appears more likely to be the current view, since

(*a*) the trees on plantations are the quite recent offspring of ex hypothese immune trees;

(*b*) the disease appears sporadically and becomes progressively serious on any plantation;

(*c*) as the mycelium is closely confined to the points of infection on the leaf, the damage done is proportional to the density of infection.

Botrytis sp.

Stahel describes a species of Botrytis as constantly found with *Melanopsammopsis Ulei* in Dutch Guiana. The fungus is not evident on Trinidad material examined by me.

Dew.

Stahel declares the disease to be worse in dry weather and attributes this to a heavier deposition of dew during fine nights enabling the spores to germinate better. The original observation is not borne out by writers or planters in British Guiana.

Soils.

Appear to have no influence on the incidence of the disease. The comparative freedom of Coast rubber is most likely due to drier atmospheric conditions.

General.

The history of the South American leaf disease, like that of the chestnut disease of the United States, should serve as a warning to those who adopt the facile view that a knowledge of the life history of a disease is the same thing as a knowledge of practical methods of control. As it happens the failure of the rubber plantations of

[1] This has since been done.

Guiana affects comparatively few, as the total planted area is small but it does not require much imagination to picture the effect of this or any other leaf disease rampant on the massed plantations of the Federated Malay States.

A good deal was written a few years ago about the necessity for a fresh importation of stock from Brazil, which was partially or entirely to replace our effete rubber and to be immune to many of our diseases. It cannot be too strongly urged that such importation if carried out should be under the strictest scientific control; although the likelihood of the importation and establishment of the South American leaf disease appears to be small, practically nothing is known of the diseases of rubber in Brazil and there is a serious risk of introducing some leaf (or other) disease comparatively harmless on the scattered trees of the jungle, which might spread to an alarming extent on our plantations.

TREATMENT OF MOULDY ROT DISEASE BY APPLICATION OF "AGRISOL."

By A. Sharples.

PROLONGED field experiments are necessary to test thoroughly the relative value of different Coal Tar products as fungicides for bark diseases. Such experiments have been delayed owing to shortage of staff, but a test has been made with "Agrisol" a proprietary fungicide, since a representative of the manufacturer was present in the country to assist in carrying out the experiments.

The first field test was made on a block of 756 trees growing on a sandy laterite soil which allowed water to drain away easily. This block showed between 150 and 160 trees affected with "Mouldy Rot" in various stages. The block was put out of tapping and the diseased bark areas were painted with a 20 per cent. solution of "Agrisol." This was followed by a second application 12 days later since one or two cases were still showing, a third application was made after a similar interval. Subsequently the trees were apparently free from disease. Tapping was resumed, and the trees were examined six weeks later for cases of re-infection. None were found, although the weather conditions in the interim were favourable to the growth of the fungus.

The progress made is shown by the following extracts from the reports of the manager:

(*a*) In all, 39 trees show signs of the disease on re-examination after a period of 12 days;

(*b*) A second examination, 24 days from commencement, shows three obvious cases. Eighteen trees show a slight blue colouring over the wood, left by the original attack of "Mouldy Rot." The bark surrounding these wounds appears to have healed and shows a healthy appearance when cut.

The last inspection was made by the writer after the block had been put back into tapping for over six weeks; there was no indication of "Mouldy Rot" on any of the trees in the experimental block.

The result of the experiment was very convincing, for the estate had previously undertaken vigorous preventive measures with but little success. Another portion of the estate inspected showed practically a 40 per cent. infection over a large area, which is a very high figure, taking into consideration the fact that preventive measures had been in operation for some twelve months. This figure leaves no doubt regarding the inefficiency of the tar mixture used previously in preventive painting.

Information received indicated that the disease in this block had been out of control for a long time. Evidence of this was not difficult to find, for numerous trees showed continuous

re-infections after treatment; as many as six separate re-infections were counted in a 12 months' removal of bark. Each re-infection, apart from the action of the fungus, meant a waste of 1½ to 2 inches of bark, because, during treatment, tapping is stopped on a diseased tree and renewed some two inches below the last cut. This results in a great wastage of tappable bark.

Since the previous test had been successful it was decided to attempt a larger experiment, to be carefully supervised daily, on a plot placed in the badly infected area described above. The soil in this plot was a sticky clay, holding water tenaciously and in spite of shallow surface drains the soil was always wet. This was advanced as a reason for so high a percentage infection and also as an argument against the value of the results of the first test conducted on land where the soil conditions were more favourable. Increased humidity of the atmosphere influences the severity of infection, and the proposed second test undoubtedly provides a thorough trial of 'Agrisol' as a fungicide under adverse conditions.

Supervision was aided considerably by a coloured form of the disinfectant which the manufacturers put on the market at the writer's suggestion. The application of this form leaves a red surface which remains visible for weeks in spite of heavy rain.

The experiment was carried out by Haji Abdul Wahid, Malay Assistant to the Mycologist, Inche Wan Idris, Laboratory Attendant to the Mycologist, and Raja Mohamed, Junior Agricultural Assistant, Muar. These three officers remained on the estate and carried out the paintings and countings themselves. The results obtained are the best tribute to their industry.

The following instructions were issued for conducting the experiment:

(1) The experiment to be limited to the number of trees that can be painted in a twelve day period. The second painting to be started on the thirteenth day.

(2) All trees, whether diseased or healthy, to be painted on the first round; healthy trees with plain "Agrisol," diseased trees with red "Agrisol." All cups, spouts, hangers to be removed from diseased trees and, on these, tapping to be stopped. Tapping to be continued on healthy trees.

(3) On the second round new cases on previously healthy trees to be marked "O" and painted with plain "Agrisol." Trees still having the fungus after 12 days to be marked "X" and painted with plain "Agrisol."

(4) On the third round after 24 days the totals of the diseased trees to be marked "XII."

(5) A further interval of 12 days after the third painting and then the totals of the diseased and of the healthy trees to be finally counted.

(6) Weather conditions to be noted daily.

In addition to the above, a control plot was established on which all the healthy trees were painted with 20 per cent. "Agrisol" solution every four days; the diseased trees were left untreated and tapping was continued on all the trees. This control plot was considered important, in order that direct evidence of the influence of the weather and other conditions on the disease during the experiment might be obtained. It was hoped that the short period paintings with the disinfectant would keep the healthy trees free from Mouldy Rot, which would otherwise have been carried to several of them from the untreated diseased trees by the tappers; only one case was found on the healthy trees during the experimental period of 36 days. The precaution was well-founded, for apart from weather conditions, tapping was wholly suspended for a period of 10 days to Chinese New Year.

The results of the second test are tabulated below:

First Painting.

Plot.	No. of trees.	Healthy.	Diseased.	Date of painting.	Percentage of diseased trees.	Remarks on weather.
1	199	102	97	2-2-21	49	Gloomy. No rain
2	350	244	106	3-2-21	30	Hot day. Slight rain
3	335	262	73	5-2-21	22	Gloomy and cloudy. Heavy rain
4	621	403	218	7-2-21	35	Very wet day. Heavy rain
5	334	227	107	9-2-21	32	Gloomy day. Rain
6	423	198	225	10-2-21	53	Gloomy day. No rain
7	256	134	122	12-2-21	47	Very cloudy and gloomy. Heavy rain
Total ...	2518	1570	948	...	37	

Second Painting.

Plot.	No. of trees.	Healthy.	Diseased.	Date of painting.	No. of new cases fresh re-infections.	No. of trees painted once and cured.	Total decrease of diseased trees.	Daily condition of weather.
1	199	109	90	14-2-21	20	27	7	Fine day. No rain
2	350	283	67	15-2-21	17	56	39	Gloomy day. Heavy rain
3	335	300	35	17-2-21	11	49	38	Fine day. Much wind. No rain
4	621	509	112	19-2-21	8	114	106	Cloudy. No rain
5	334	241	93	21-2-21	3	17	14	Cloudy. High wind. No rain
6	423	277	146	22-2-21	15	94	79	Beautiful day. No rain
7	256	207	49	24-2-21	13	86	73	Fine day. Much wind. No rain
Total ...	2,518	1,926	592	...	87	443	356	=38 per cent. Improvement

Third Painting.

Plot.	No. of trees.	Healthy.	Diseased.	Date of Painting.	No. of fresh infections not painted on 2nd round, but infected after 24 days.	No. of trees painted once and cured.	No. of trees painted twice and cured.	Daily weather condition.
1	199	165	4	26-2-21	4	27	67	Much high wind. Hot day. No rain
2	350	350	—	27-2-21	Nil	56	50	Very hot day. No rain
3	335	333	2	1-3-21	2	49	24	Wet morning. Fine day. No rain
4	621	611	10	3-3-21	10	114	112	Fine day. Rain
5	334	334	Nil	5-3-21	Nil	17	73	Wet morning. Fine day. No rain
6	423	423	Nil	6-3-21	Nil	94	131	Wet morning. Fine day. No rain
7	256	254	2	8-3-21	2	86	36	Gloomy morning. No rain
Total ...	2,518	2,500	18	....	18	443	493	

While the painted plots were free from Mouldy Rot, the unpainted diseased trees in the control plot still showed a conspicuous amount of the disease; there were practically no recoveries and the fungus was progressing well. There could, therefore, be no doubt that the conditions obtaining during the experiments were quite favourable to the growth and spread of the fungus.

The first point that may be deduced from these two experiments is, that, under the conditions given, "Agrisol," used in the form of a 20 per cent. solution and at 12 days intervals is a reliable fungicide for Mouldy Rot. The conditions, especially in the second test were unfavourable and it is reasonable to expect that the treatment would be equally successful under any conditions likely to occur on plantations run on progressive lines though this point should be tested further by experiments in different localities. It may be pointed out that in this instance the work was carefully done by selected officers and that this may have had an influence on the results; but in any case thorough and careful work is always necessary for the successful treatment of diseases. One advantage of "Agrisol" is that it is almost fool-proof; it is easily miscible with water and strong solutions do not harm the tender cortical tissues. The only precaution to be taken is to stir the solution immediately before application, since some of the heavier constituents show a tendency to settle.

It may be stated decisively that single painting with "Agrisol" is useless, for many cases retain the fungus in a vigorous state of growth after the first painting and would act as centres from which re-infection would spread in all directions. The secret of success lies in continuous painting and it would appear that even the most heavily infected areas are amenable to such treatment.

Emphasis should be laid on the point that, during the second test, tapping was continued on the healthy trees in the treated plots. It is thus possible, if the work is done carefully, to continue tapping the healthy trees in an infected task under treatment and so reduce the loss occasioned, when all the trees in infected tasks are put out of tapping.

Further evidence as to value of "Agrisol" under field conditions was obtained from the divisional superintendent of the estate, who supervised the first and smaller test described above. Since the experiment was carried out, he has used "Agrisol" continuously as a preventive for Mouldy Rot and states that the disease is no longer troublesome, whereas previously it was never well under control when other disinfectants or mixtures of disinfectants were used. The worst infected areas on his division border on native kampongs, very badly infected with Mouldy Rot. Even in these areas, previously always troublesome, the disease is now kept under control.

The procedure to be recommended in using "Agrisol" is simple.

A.—*Badly Infected Areas.*—These must be treated intensively on the following lines:

(1) The work must be so arranged that the number of trees under treatment can be painted in a twelve day period.

(2) All trees, whether diseased or healthy, should be painted on the first round; healthy trees with plain "Agrisol," diseased trees with red "Agrisol." All cups, spouts, and hangers should be removed from diseased trees and be disinfected with "Agrisol." Tapping should be stopped on diseased trees, but may be continued on healthy trees.

(3) On the second round, new cases on previously healthy trees, should be marked 'O" and painted with plain "Agrisol." Trees still showing the fungus after 12 days should be marked "X" and be painted with plain 'Agrisol."

(4) On the third round, after 24 days, the totals of diseased and healthy trees should be taken and diseased trees should be painted with plain "Agrisol" and marked "XII."

(5) After a further 12 days the totals of diseased and health trees should be finally counted. If any diseased trees still remain, they can be painted again.

Any system of marking may be employed, but some system is necessary, if strict supervision is to be maintained. Such strict supervision is absolutely necessary in badly infected blocks. The Red "Agrisol" which leaves a broad red band, after painting diseased bark, is recommended for use in heavily infected blocks, since it aids supervision. It is, however, more expensive than the uncoloured disinfectant.

B.—*Lightly Infected Areas.*—The disease can be controlled in such fields by the simple expedient of a 12 days treatment and inspection. Special coolies should be trained and put on as "Mouldy Rot" painters; their respective tasks should be limited by the number of trees they can inspect in 12 days. This would probably amount to about 100 acres for each cooly. On the thirteenth day a return to the starting point should be made. On each round any diseased tree found should be marked, put out of tapping and painted with a 20 per cent. solution of "Agrisol;" the cups, spouts and hangers should be disinfected with the "Agrisol" solution. On the subsequent round, any marked trees still infected should be painted again and marked a second time. If at the expiration of one month from the date of the first painting the treated trees show no sign of Mouldy Rot, tapping can be recommended one to two inches below the last cut. The monthly period allows for three paintings taking place respectively on the 1st, 13th and 25th day. The secret of success lies in successive paintings; one is seldom sufficient, two usually clear up the

diseased bark, but in difficult cases three paintings are often necessary. Some supervision is necessary and the system of marking employed must be devised to aid this; if, however, the painting coolies are well trained and recognize clearly the area to which their inspection is limited, there should be but little difficulty in controlling the spread of the disease.

Similar experiments with other coal tar disinfectants are contemplated for purposes of comparison. When these experiments can be carried out it is hoped that it will be possible to show comparative costs as well as comparative results.

I have much pleasure in expressing my indebtedness to Mr. A. R. Byatt, representative of Messrs. Major & Co., for his personal help and constant interest in the above experiments. His help in supervision was invaluable; without this it is doubtful if the experiments could have been successfully conducted.

PRELIMINARY NOTES ON THE "KADONDONG" BEETLE, PODONTIA 14-PUNCTATA, LINN.

G. H. Corbett and Mohamed Yusope.

(i) *Introduction.*

This beetle, *Podontia 14-punctata*,* Linn., was reported in March, 1920, for the first time damaging the Otaheiti apple or "Kadondong" (*Spondias dulcis*) at the Empire Hotel, Kuala Lumpur.

There are few recorded instances as to the economic importance of this insect. Barlow in "Indian Museum Notes," Volume IV, page 68, refers to this beetle as follows:

"In the early part of October, 1895, specimens of this Chrysomelid beetle in all stages of development were received in the Indian Museum through Mr. C. O. Bateman with the statement that they were devouring the leaves of a Hog-plum tree (*Spondias mangifera*) growing in the compound of his house in Calcutta. According to the information gathered the beetles make their appearance on the tree, almost every year, about the time when the tree is in full foliage, in the month of July and August, and disappear in the latter part of October."

Lefroy in "Indian Insect Life," page 360, records the above.

When the "Kadondong" trees were inspected in March, 1920, all the leaves had been eaten and some branches were entirely bare. No young shoots were to be seen.

Owing to the serious nature of the damage caused by this insect a study of the life history and control of this beetle was undertaken and preliminary results of these investigations are now recorded.

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* Kindly identified by Dr. Guy A. K. Marshall of the Imperial Bureau of Entomology as Podontia 14-punctata, Linn.

"KADONDONG" BEETLE, PODONTIA 14 PUNCTATA, LINN.

EGG MASS

1

LARVA

2

PUPA

3

COCOON

4

ADULT

5

THE LA MARE MORRIS

(ii) *Brief Descriptions of the Stages.*

(1) Egg.

The egg of the "Kadondong" beetle is oval in shape and rounded at both ends, at first bright yellow in colour changing later to a dull yellowish white. The length and breadth of the egg are variable; measurements of 117 eggs give a minimum length of 1.5 m.m., a maximum of 2.0 m.m., and an average of 1.96 m.m., and a minimum breadth of 0.70 m.m., a maximum of 1.00 m.m., and an average of 0.84 m.m.

(2) Larva.

The newly emerged larva is somewhat onisciform, i.e., in shape like a wood louse, bright yellow in colour wih a black head, six rows of black spots, from each of which a hair arises, running longitudinally throughout the body, three pairs of black legs on the three thoracic segments, and a black shield on the first thoracic segment with ten anterior projections. There is a yellowish pseudopod (protrusible sucker) at the anal extremity provided with projections which aid the grub to adhere to or clasp the leaves.

The full grown larva differs from the newly emerged by being greenish in colour and larger in size.

Table I.

Measurements of 10 full grown Larvae.

Larval number.	Length. m.m.	Breadth. m.m.	Larval number.	Length. m.m.	Breadth. m.m.
1	24.5	8.2	6	25.6	8.0
2	22.7	8.1	7	25.7	7.5
3	23.4	8.1	8	24.4	8.1
4	21.9	8.3	9	22.5	7.5
5	23.5	8.2	10	24.2	8.2

The above table gives the average length as 23.84 m.m. and breadth as 8.02 m.m.

(3) Pupa.

The pupa is short, stout, bright yellow in colour with black eyes and mouth parts.

The average length of the pupa is 15.2 m.m. and the average breadth 7.4.m.m.

(4) Cocoon.

When full grown the larvae usually enter the soil and form oval cocoons of particles of soil. The average length is 18 m.m. and the average breadth 12 m.m.

(5) Adult.

The mature insect is rather a handsome beetle, the male of which is on an average 15 m.m. in length and the female 16 m.m., the average breadth is 7.4 m.m. and 7.5 m.m. respectively.

The wing covers of both sexes are pink with fourteen conspicious back markings on the elytra. The number of these spots is slightly variable, in some as many as sixteen spots have been counted.

The antennae, head, prothorax, legs, and abdomen are bright yellow, and the eyes and mouth parts black.

(iii) *Food Plants.*

This beetle has not been found in Malaya to feed on any other plant but the Otaheiti apple (*Spondias dulcis*). In India it is recorded as feeding on Hog-plum (*Spondias mangifera*).

(iv) *Life History and Habits.*

Egg.—The female beetles deposit eggs by day and night in batches on the leaves; individual eggs on the leaves have never been observed.

The eggs are very conspicuous and always seen on the undersurface of the leaves; preference being shown for the tips of the leaves.

In depositing the egg mass, the female at first commences with a spherical foundation of eggs which are placed perpendicularly to the surface and touching one another. After the base of the cluster is finished, the female places another layer of eggs above. This layer is usually found in all directions but occasionally in an upright position.

The number of eggs in each group varies. The following figures represent the counts of individual egg masses collected from the field; 35, 64, 31, 59, 40, 36, 41, 27, 40, 29, 24, 18, 34 and 32.

These numbers give an average of 36.4 eggs to each mass.

TABLE II.

Duration of Egg Stage.

The following figures for the incubation of the egg were obtained from eggs laid in the field and kept under laboratory conditions at Kuala Lumpur, 1920.

Eggs under observation.	Date of deposition.	Approximate length of egg stage in days.	Total egg days.
27	April, 4	7	189
41	,, 4	7	287
32	May, 23	6	192
28	,, 23	7	196
21	,, 24	7	147
41	,, 28	7	287
30	,, 29	7	210
22	,, 30	6	132
22	,, 31	7	154
56	June, 2	6	336
13	,, 3	6	78
31	,, 4	6	186
38	,, 5	7	266
37	,, 6	7	259
24	,, 7	7	168
22	,, 13	7	154
5	,, 14	8	40
10	,, 16	8	80
46	,, 25	7	322
43	,, 27	6	258
56	July, 3	7	392
31	,, 5	7	217
35	,, 6	7	245
22	,, 8	6	132
32	,, 14	7	224
36	,, 16	6	216
21	August, 6	7	147
46	,, 9	6	276
22	,, 11	6	132
31	,, 13	6	186
33	,, 17	6	198
35	,, 23	7	245
989	...	...	6,551

From the above figures it will be seen that the time for the incubation of egg varies from 6-8 days and the average is 6.62 days, but of the 989 eggs 387 hatched on the sixth, 587 on the seventh and 15 on the eighth day.

Larva.—The larvae, after escaping from the eggs, are readily seen living gregariously and skeletonising the leaves for two or three days, afterwards migrating to different parts of the plant, they commence to eat the whole leaves.

The anus is situated just above the base of the protrusible sucker foot, and by curving the terminal segment of the abdomen

upwards the grubs deposit their excrement on the body. This is prevented from falling by an exudation from the body of the larvae.

The excreta frequently form complete coverings over the grub, and undoubtedly serve as a protection against predaceous and parasitic enemies.

The larvae when disturbed roll themselves up into a ball somewhat after the manner of a wood louse.

TABLE III.

Length of time spent on the leaves by the Larvae of the "Kadondong" beetle.

Number of larvae under observation.	Dates larvae emerged from eggs.	Aproximate length of time (in days) larvae on leaves.	Total number of larval days.
4	May, 31	13	52
11	„ 31	14	154
6	„ 31	15	90
27	June, 4	11	297
14	„ 4	12	168
30	„ 5	11	330
22	„ 5	12	264
22	„ 7	12	264
18	„ 8	14	252
29	„ 8	15	435
9	„ 8	16	144
10	„ 9	13	130
4	„ 9	14	56
2	„ 9	12	24
11	„ 9	13	143
9	„ 10	13	117
22	„ 10	14	308
23	„ 12	13	299
15	„ 12	14	210
7	„ 15	16	112
11	„ 15	17	187
9	„ 15	18	162
19	„ 19	16	304
15	„ 19	17	255
6	„ 19	18	108
23	„ 23	13	299
10	„ 23	14	140
16	„ 23	15	90
19	„ 24	14	266
413	...	...	5,660

The minimum number of days for the larval period is eleven, the maximum eighteen with an average of 13.70 days. Of the 413 larvae, 57 were feeding on the leaves for eleven, 60 for twelve, 80 for thirteen, 99 for fourteen, 41 for fifteen, 35 for sixteen, 26 for seventeen, and 15 for eighteen days.

Pupa.—When full grown the larvae generally enter the soil for pupation. Prior to changing into pupae they make oval cocoons of particles of earth within which they pupate.

The depth at which the cocoons are found varies from two inches to six inches according to the condition of the soil. Occasionally cocoons are found underneath rubbish and pieces of wood.

TABLE IV.

Length of time elapsing between the entrance of the larvae in the soil and the emergence of the adults.

Number of larvae entered the soil.	Date larvae entered the soil	Approximate number of days taken to emerge as adults.	Total pupal days.
3	June, 10	25	75
1	„ 15	22	22
13	„ 19	23	299
3	„ 22	22	66
2	„ 22	22	44
4	„ 23	19	76
1	„ 23	21	21
1	„ 24	22	22
2	„ 26	14	28
7	„ 28	20	140
1	July, 1	19	19
2	„ 2	18	36
1	„ 3	17	17
4	„ 3	19	76
9	„ 23	23	207
7	August, 3	27	189
4	October, 1	29	116
65	...	...	1,453

The maximum number of days elapsing between the entrance of the larvae in and the emergence of the adult from the soil is 29, the minimum is 14, and the average is 22.35.

Adult.—The beetles as well as the larvae avoid sunlight and are usually found on the under surface of the leaves. They feed intermittingly both day and night.

They do not fly readily and when thrown in the air frequently make no attempt at flight. When disturbed on the leaves they usually drop to the ground and for a short time feign death.

TABLE V

Duration of Egg Laying: Productivity of Females.

Cage No.	Date adults placed in cage.	Date first eggs obtained.	Number of egg masses.	Total No. of eggs.	Date last eggs laid.	Period of oviposition in days.	Date females died.
* 1	25-3-20	23-6-20	28	1,088	23-8-20	61	9-9-20
* 2	25-3-20	11-6-20	3	76	14-6-20	3	21-6-20
† 3	7-7-20	26-7-20	5	89	13-8-20	18	29-8-20
† 4	7-7-20	3-9-20	5	118	4-10-20	31	3-11-20
† 5	8-7-20	18-9-20	4	112	4-10-20	16	11-10-20

* Females and males collected from the field.

† Females and males bred from eggs from the laboratory.

The productivity of the individual in Cage No. 1 is remarkable in comparison with the females in the other cages.

The lifetime of the the females of Podontia 14-punctata varies considerably and the above figures show fluctuations between 53 and 168 days. The period before the females reared in the laboratory became sexually mature was from 19 to 72 days.

Synopsis of the Life History of Podontia 14-punctata.

	Minimum.	Maximum.	Average.
Egg Stage in days ...	6	8	6.62
Larval „ ...	11	18	13.70
Pupal „ ...	14	29	22.35
Total number of days ...	31	55	42.67

From the foregoing figures it will be seen that the beetles may complete their life cycle in thirty-one days and may take as many as fifty-five, the average being 42.67 days.

(v) *Natural Enemies.*

A Parasitic Insect.—Only one parasite of the "Kadondong" beetle has been obtained viz.: a Chalcid egg parasite.* These black minute hymenopterous parasites, measuring about 1 m.m. in length, are very active jumping readily when disturbed, and are conspicuous when depositing their eggs in the yellowish eggs of Podontia.

Parasitised eggs maintain their normal yellowish colour until about three days previous to the emergence of the parasite.

Oviposition was observed several times. In a typical instance the female walks over an egg mass and examines an egg carefully with her antennae which she waves about. Suddenly she stops and taking up a position at an angle of about forty-five degrees to the egg surface, inserts her ovipositor into an egg of Podontia. After laying an egg and withdrawing her ovipositor, she examines the place of deposition with her antennae and then proceeds in her useful control work.

The parasites in three hours after emergence are capable of laying eggs inside the eggs of Podontia.

The average length of time the parasite lives in captivity is nine days.

Observations from eighteen cages with respect to the length of time elapsing between oviposition and the emergence of the parasite give the following data:

In two cages, the winged adult parasites emerged on the sixth day; in one on the seventh; in one the ninth; in nine on the tenth; in four on the eleventh, and in one on the twelfth.

These breeding records show that the numbers of parasites emerging from eggs laid by individual female parasites in the eggs of "Kadondong" beetle are 27, 20, and 19, and the largest number emerging from one day's egg laying is 11.

In the majority of cases it has been found that only one parasite emerges from an egg of Podontia but two in a number of instances have been observed. Three parasites from one egg have never been obtained. When two parasites emerge from an egg of Podontia, they have their separate exit holes.

The percentage of parasitisation is at times very high. Some egg groups have been collected in the field completely parasitised and a large number with a percentage of parasitisation of over 90.

(vi) *Methods of Control.*

The egg parasite previously mentioned undoubtedly prevents a number of grubs hatching from eggs but though exercising a certain degree of control, it cannot be said to be entirely effective or otherwise there would not have been extensive damage to "Kadondong" and, methods of control should be employed.

* This parasite is at present unidentified in the Entomological collection.

(1) The period during which the grubs and beetles feed exposed on the leaves affords ample opportunity for spraying measures and by experiment it has been found that one spraying of Lead Arsenate at the rate of two pounds to fifty gallons of water practically exterminates both beetles and larvae. This spraying should be followed by two others one in about nine days to kill the larvae which have hatched from egg and the other in about nine days to kill the beetles which have emerged from the ground.

Spraying the trees should be done in the late afternoon to present the scorching of the leaves.

(2) The egg masses should be collected and placed in a tray surrounded by water or oil in such a manner that grubs hatching from the eggs are unable to escape, whilst the parasitic flies emerging from the eggs may fly away to continue the beneficial work of egg destruction.

(3) The cultivation of the soil under the infested trees will destroy the pupae to some extent by breaking up the cocoons and exposing the pupae, or by burying the cocoons so deeply into the soil that some of the beetles are unable to work their way to the surface.

(4) A measure of benefit may be obtained by spreading a sheet under the infested trees and jarring them. The beetles falling on the sheet are readily seen and collected.

(5) If the attack is not severe hand collecting the eggs, grubs, and beetles is only necessary.

WORK OF THE INSPECTION STAFF, JULY-SEPTEMBER, 1921.

By F. W. South.

Appointments.

THE Staff of Special Field Officers was increased during the quarter by the filling of two extra appointments in Negri Sembilan, in connection with the control work on Mouldy Rot, and two in Selangor, to deal more particularly with Pink Disease.

Inspection Visits.

Sixty-three visits were paid by members of the Inspection Staff to estates in various parts of the country.

Applications from rubber estates are becoming less numerous and this may possibly be taken as an indication that enforced economy is necessitating less attention to pests and diseases and inducing less interest in them.

Now that operations generally are being almost entirely suspended on a number of estates, it is becoming desirable that the Inspecting Officers should devote a larger portion of their time to visiting estates to see that no diseases are becoming prevalent on those on which little work is being done.

Control of Pests and Diseases on Abandoned Rubber Land.

The measures outlined in my report for the previous quarter have been practically completed. The Government provided a special vote of $75,000 to meet the first cost of doing any work required in the form of a loan to be recovered later. As shown above, the necessary additional temporary officers have been engaged.

Some details of the work are given under Pink Disease and Mouldy Rot below.

Diseases of Rubber.

Pink Disease.—This disease was reported for the first time on one estate in Perak North, two estates in Selangor, two in Negri Sembilan and three in Johore. Speaking generally, the disease was kept effectively under control during the quarter; the drier weather prevalent acted as a successful check. The special points of interest are in Selangor and Malacca. In the Settlement Pink Disease was found on one tree in each of two adjoining holdings at Chabau. The diseased trees were promptly cut out and burnt and no more cases have been recorded. This is the first authentic record of the occurrence of the disease in Malacca.

In Selangor useful work was done by the Special Field Officers in Ulu Selangor district. Several badly infected holdings were cleaned up by these officers who subsequently recovered the cost of the work. Pressure induced other owners to have the work properly done themselves, while others, seeing that treatment was being firmly enforced, did the work themselves before receiving notices. There have been a few prosecutions for failure to carry out instructions, but more frequently the work has been done and the cost has been recovered. As the work progresses there should be a marked reduction in the number of cases of this disease in the district.

Mouldy Rot.—The disease was reported as newly-found on only one estate during the quarter. This was in Malacca and constitutes the first certain outbreak of the disease in the Settlement. The owner and the Assistant Agricultural Inspector are making every effort to eradicate the disease. A careful search has been made, but no infections have been found elsewhere in the neighbourhood. The Planters' Associations have been informed of the outbreak.

In Negri Sembilan a long spell of dry weather has much reduced the severity of this disease in all districts, except on holdings where the undergrowth is thick and consequently damp conditions are maintained around the lower four or six feet of the trees.

Arrangements are now completed for carrying out treatment on holdings where owners do not comply with instructions.

In Temerloh district in Pahang the disease is confined to Chinese owned holdings on the eastern side of the railway line at Mentakab. Most of the owners of these live in Malacca or Kuala Lumpur. The area affected is comparatively small, but the attack is severe. It is hoped that the Special Field Officer from Jelebu may be transferred to Pahang during the coming quarter to supervise work in the infected locality.

In Johore a few cases have been found in Johore Bahru district, but prompt attention to infected trees has resulted in checking the spread of the disease there. In Segamat and Panchor districts there has been an improvement, although there are still a large number of cases. In the former district, heavy fines have had a useful effect. The recent outbreak near Muar is by far the most important in the State. The district contains thousands of holdings, averaging under three acres in area. It is low-lying and damp, the trees are closely planted and the amount of undergrowth is remarkable; many holdings are impenetrable except along the rentices cut for tapping. The result is that a large majority of the trees in this district have become infected with Mouldy Rot.

The amount of infection is gradually being reduced but eradication of the disease is not even in view. Attention is being paid to clearing the undergrowth and to painting affected trees, but unless the former is attended to the latter is of very little use.

Black Stripe.—In spite of the dry weather this disease appeared again in Jelebu district, Negri Sembilan. Outbreaks are receiving careful attention and treatment.

Patch Canker.—Is reported to have attacked three trees on an estate in Malacca. The trees were cut out and burnt as they could easily be spared.

Coconut Pests and Diseases.

Brachartona Catoxantha.—This pest disappeared from the attacked area near Kuala Selangor and no further record of it near Johore Bahru is made. In Kinta it was found in a new locality near Kampar but the area affected was small. Two insects were controlling the attack at the other centre in Kinta near Menglembu. Leaves with caterpillars attacked by the fungus parasite were brought from Telok Ayer Tawar in P. W. and given to the owner at Menglembu to tie into his attacked tree.

The important attack at Telok Ayer Tawar decreased in severity mainly owing to parasitisation by the fungus. Very few moths appeared at the last emergence. The tying of leaves bearing insects well infected with the fungus into the trees was found to be the best means of encouraging the fungus and thus of controlling the pest.

Beetles.—Oryctes rhinoceros and *Rhyncophorus Schach.* The enforcement of general sanitation for the control of these insects has proceeded steadily throughout the country and its effect will become apparent probably during next year. Owing to the persistence of the damaged leaves on the trees for twelve months or more, the improvement due to the absence of the beetles only appears slowly. Large numbers of grubs have been destroyed and many suitable breeding places have been eliminated.

The work commenced in Singapore island during last quarter has progressed well and much attention is now being given to the control of beetles there.

In Johore, both insects have been found to be prevalent in Batu Pahat and Muar districts and action is being taken to control them.

The Incinerator at Alor Gajah remained in daily use throughout the quarter, but beetle grubs still occur in the site of the old rubbish heap.

Padi Pests.

Stem Borer.—In Krian in early July a thorough investigation was made into the prevalence of stem borer in the self sown padi and young shoots growing from old stools in the bindangs. The pest was found to be well distributed throughout the district and there was no indication that any parasite was acting as a control. It was, therefore, decided to take prompt measures to enforce, if possible, the burning of all such growing padi. In some localities the bindangs were full of padi shoots and self-sown plants and it would have entailed great expense and much labour to have destroyed all padi growing in them.

Pianggang.—(*Leptocorisa varicornis.*) This pest had not appeared on the earliest planted padi in Pahang, but there were sporadic attacks reported from Berisu and Jasin in Malacca; these, however, have given little or no trouble.

Army worms.—These were reported from the same two localities in Malacca but did little harm and were destroyed by rain.

Rats.—These caused trouble in Kuala Selangor and Tampin districts. They were effectively controlled in Tampin district by the use of poisons and by hunting with dogs. In Kuala Selangor the attempt to use poisons was not very successful.

MINUTES OF SPECIAL GENERAL MEETING OF THE PLANTERS' ASSOCIATION OF MALAYA,

held at 12, Market Street, Kuala Lumpur, on 11th August, 1921, at 11 a.m.

PRESENT:

Mr. T. J. Cumming (*Chairman*)

The Hon. Mr. C. Bradbery (*Vice-Chairman*)

Mr. C. Ward-Jackson (*Secretary*)

and the following members:

from the	Bahau-Kuala Pilah D.P.A.	Messrs. C. W. Keppel-Powis and J. Mappin
„	Batang Padang D.P.A. ...	Messrs. C. B. Graburn, H. Gordon Graham, L. Faulkener Willis and J. M. P. Landon
„	Johore P.A.	Mr. W. Miller Mackay
„	Kajang D.P.A.	Messrs. K. G. Furley, E. G. Leyne and C. H. Miller
„	Klang D.P.A.	Messrs. G. H. Bennett, W. S. Reeve-Tucker, Chris. Harrison, R. Battiscombe and R. T. Richardson
„	Kuala Langat D.P.A. ...	Mr. A. Keightley Smith
„	Kuala Lumpur D.P.A. ...	Messrs. V. Utterson Kelso, W. R. Shelton-Agar, and R. G. Ladell
„	Kuala Selangor D.P.A. ...	Mr. J. Bligh-Orr and Major A. B. Slee
„	Malay Peninsula Agricultural Association ...	The Hon. Mr. R. C. M. Kindersley
„	Negri Sembilan P.A. ...	Messrs. C. Ritchie, V. A. Tayler, W. B. Monilaws and J. Walker
„	Ulu Selangor D.P.A. ...	Messrs. L. W. Tivy, A. P. Mackilligan R. M. Newton and M. J. Kennaway

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1.—MINUTES.

On the motion of Mr. Graburn, seconded by Mr. Reeve-Tucker, the minutes of the annual meeting held on 19th May, 1921, are confirmed.

2.—AMENDED BUDGET FOR 1921-22.

Mr. CUMMING says that at the last meeting of the Association the budget was referred back to the Standing Committee for further consideration. The Standing Committee appointed a Sub-Committee to go into all matters connected with finance. This Committee sat three times and had all the details of expenditure worked out and they were enabled to reduce the assessment to two cents per planted acre which was a reduction of half cent an acre. The Sub-Committee also suggested the cutting out of a good deal of printed matter. Only a summary of the proceedings of the Standing Committee meetings would be

circulated to Constituent Associations in the future. On the other hand the Standing Committee found it necessary to increase the estimate for travelling expenses to $1,200. The members of the Standing Committee were allowed 10 cents a mile for travelling expenses when they attended meetings. The Standing Committee had come to a compromise with the Secretary of the Association who had an agreement. In consideration for the cancellation of the agreement they had offered the Secretary three months' salary and a commencing salary of $500 from April, 1921. The amended budget is as follows together with the budget originally proposed:

	New	Old
	$	$
Publications, printing and stationery ...	1,500	2,500
Library	*nil*	100
Rent	400	500
Legal advice	100	250
Standing committee	1,200	1,000
Administration charges	8,700	9,000
Travelling and other contingencies ...	200	300
Postages	350	500
	$12,450	$14,150

Mr. Shelton-Agar asks whether he understood the Chairman to say that the reduction in the Secretary's salary had been made retrospective to 1st April. He understands it was only decided in the middle of June to reduce the Secretary's salary.

Mr. Cumming replies that a compromise has been made with the Secretary who has been given three months' salary to compensate him for the loss of his agreement.

On the motion of Mr. Monilaws, seconded by Mr. Leyne, the amended budget as presented is carried *nem dis*.

3.—ALTERATION OF RULES.

Mr. Cumming says it has been resolved by the Standing Committee that paragraph 5 of Rule 19 be rescinded and the following substituted therefor:

> "Each Constituent Association shall forward to the Secretary not later than 31st March each year on a prescribed form the names of its nominees for membership of the Standing Committee for the ensuing year. The Secretary shall then issue voting papers to each Constituent Association containing the names of nominees for such number of representatives on the Standing Committee as the Constituent Associations in each State or Territory shall be entitled to and such voting papers shall be returned to the Secretary on or before a day to be notified."

He explains that the effect of the alteration, if passed, will be to provide that each Constituent Association of the Planters' Association of Malaya shall forward to the Secretary not later than 31st March each year the names of its nominees for membership of the Standing Committee for the ensuing year. Under paragraphs 3 and 4 of Rule 19, each Constituent Association will be notified of the number of representatives on the Standing Committee to which the State or Territory in which it is domiciled is entitled.

On receipt of the nominees of Constituent Associations, a voting paper will be drawn up for each of the States or Territories referred to in paragraph 2 of Rule 19 and each member of each Constituent Association in each Territory will receive a copy of the voting paper upon which he may record his vote or votes.

Mr. RITCHIE says that as he understood it each District Association would receive a voting paper containing the names of the members nominated and each State would be entitled to elect a certain number of members. For instance Negri Sembilan might be entitled to cast three votes. Might they be cast for one nominee or for three? There was the danger of a small Association being unable to elect anybody. He wishes to have a ruling from the Chair on the point.

Mr. CUMMING says he himself is not in favour of "plumping," and he is sure the Standing Committee will provide against it and in the prescribed form of voting paper it will be made unmistakeably clear that members may record only one vote for any one candidate.

On the motion of Mr. CUMMING, seconded by Mr. BRADBERY, paragraph 5 of Rule 19 is rescinded and the paragraph approved by the Standing Committee is substituted therefor.

4.—LABOUR MATTERS.

Mr. CUMMING says the Standing Committee had before it the new Indian Emigration Bill. After consideration the Standing Committee wrote to the Indian Immigration Committee asking them what steps were being taken in order that the interests of Malaya might be safe guarded. From the Indian Immigration Committee he understood that no public action on the question was at present desirable. They were also told that the Federated Malay States Government was in communication with the Indian Government on the matter and were not neglecting the question.

Mr. GRABURN says it is the wish of the Batang Padang Association that he should bring up the question of Indian labour in this country, referring more to the future. The Chairman had mentioned the new Immigration Bill as being one of the things which was likely to operate against future recruiting. On the other hand the conditions in this country at the present time

were also going to affect the future of recruiting, that is to say, if they kept on reducing the wages of their coolies and so many coolies were allowed to go away. They had heard that two recruiting offices in India had had to close down. The result was that recruiting conditions in India were going to be seriously affected. Therefore unless some prompt and definite action were taken recruiting connections in India would be lost—lost after they had taken so many years to build them up. If estates were unable to keep their labour forces and if better wages could be obtained in their own country the Tamil labourer was not likely to come to Malaya. Whatever profits estates might otherwise be able to make in the future when conditions improved would be swallowed up in the high wages which they would have to pay in order to get labour. He refers to a recent report of a meeting of the Central Pahang Planters' Association, in which it was stated that during the recent 10 cents a pound rise in the price of rubber native holders in Pahang offered exorbitant wages to coolies. He considers that Government has a moral duty to perform in keeping labour in the country and the Association should take ample and immediate measures to see that the coolies were not allowed to leave the country in such large numbers. Otherwise with the turn of the tide they would be faced with a very serious labour shortage. With regard to propaganda against recruiting they had only to read the exchange of telegrams between the Government of India and this Government recently as the result of an article in *The Hindu*. He inquires whether the Planters' Association of Malaya can give some guarantee with regard to the future of labour.

Mr. Bradbery refers to the Indian Emigration Bill, and says it would appear to him that the sooner employers of labour in Malaya set about putting their house in order the better. He understands that in Ceylon a Bill is about to be made an Ordinance which will make it impossible for a labourer to be sent to prison because he absconds, neglects his work, is insolent or disobedient. He thinks we in Malaya should straightaway make a move towards the abolition of the penal clauses from our Labour Code. He believes he is correct in saying that the professional agitator—the anti-emigrationist and the anti-recruiter—in India has made much capital out of the fact of the existence of these penal clauses. He is aware that the powers employers possess under these clauses are, in some quarters, regarded as useful even if they are rarely exercised; but he is sure that the average fair-minded estate manager will recognise that for various reasons the time has arrived for the abolition of these powers. It is Malaya's boast that her labour is free. A labourer has the right to leave his employment at any time by giving one month's notice, and he thinks we shall be doing a great public service if we move now to have the penal clauses from our Labour Code abolished. He proposes the following motion:

> "That this meeting is in favour of the abolition of the penal clauses from the Labour Code and that the matter be referred to the Standing Committee for action."

Mr. Shelton-Agar says there is one point which should not be lost sight off and that is the fact that those penal clauses should be retained which are absolutely necessary for the preservation of order on estates.

Mr. Harrison thinks the matter is one upon which they should not be rushed into a decision.

Mr. Cumming calls attention to the fact that Mr. Bradbery suggests that the Standing Committee should inquire into the matter.

Mr. Bradbery thinks that if the meeting is going to discuss the question and not come to a decision such discussion should be kept out of the Press as far as possible.

Mr. Ritchie suggests that the matter be referred back to the Standing Committee and that the Standing Committee's considered view be put before the next meeting of the Association. In the meantime the District Associations should be asked to discuss the matter.

Mr. Bennett thinks that the Standing Committee should express its opinion before Constituent Associations are asked to discuss the matter.

Mr. Cumming asks whether Mr. Graburn has any resolution to put before the meeting as to the future of labour.

Mr. Graburn says it is too big a question and he has no resolution to put before the meeting. He only wants the matter to be considered by the Association.

Mr. Cumming thinks the question of the deletion of the penal clauses might be considered by the Standing Committee and that their views might be circulated to the District Planters' Associations for consideration before the next meeting of the Association.

Mr. Utterson Kelso thinks it is important that the connection of our kanganies with India should be maintained and points out that advantages would be gained by guaranteeing to labourers a safe wage for a number of years, say, 30 cents a day for five or 10 years.

Mr. Kindersley supports Mr. Bradbery and thinks that if planters themselves do not take steps to have the penal clauses deleted from the Labour Code the Government may take steps to do so. He also agrees with the view that the matter should not be rushed. It is common knowledge that no one wants labour to go away from the country but they could not help it. They had not the money to keep their labour. He thinks Government is in much the same position.

Mr. CUMMING is sure that the penal clauses must go sometime. He suggests that the question of abolishing the penal clauses and also the matters raised by Mr. Graburn as regards labour be referred to the Standing Committee.

Agreed to.

The SECRETARY submits the following:

MEMORANDUM ON THE CARE OF PREGNANT WOMEN ON ESTATES, PREPARED BY THE PRINCIPAL MEDICAL OFFICER, F.M.S.

1. No female labourer should perform heavy tasks such as weeding, lifting heavy weights after the sixth month of pregnancy or until the second month after her confinement.

2. The Visiting Medical Practitioner and the Dresser in Charge should make periodical inspections of pregnant women once a week for "Brights" indicated by swollen feet and albumen in the urine, instestinal worms indicated by anæmia and diagnosed by microscope examination of the stools, anæmia diagnosed by pallor of the gums and inner side of the eyelid. Anæmia can be estimated by the use of Talliquists haemoglobinometer. This consists of a number of pieces of blotting paper in a small book. The finger is punctured and a drop of blood is sucked up on one of the pieces of blotting paper. When dry this is compared with a scale coloured various shades of red. When the blood agrees with a shade of red on the scale the degree of anæmia if present can be read off with an error of only 5 per cent.—10 per cent. When the anæmia present amounts to 30 per cent. the patient should be sent to hospital. The blood should be examined twice a month for malarial parasites.

3. Estate labourers should be informed that their wives will be treated free in hospital for confinement or pregnancy and there should be no delay in sending confinement cases into hospital.

CIRCULAR.

The Indian Immigration Committee desire to impress upon all employers of Indian labour the necessity of paying assessment without undue delay. In conformity with the general depression and financial stringency the Committee have lowered the rate each quarter and have prescribed a rate of only 50 cents per unit for the fourth quarter of this year. It is hoped by so doing that those employers who are in arrears will be enabled to get up to date in their payments.

In prescribing these low rates the Committee are compelled to draw on the reserves of the Fund to meet the difference between receipts and expenditure and they earnestly request all employers to make punctual payment of assessment so that the low rates can be maintained as long as possible without prejudicially affecting the recruiting organisation in this country and in India.

(Sgd.) W. PEEL,
Chairman,
Indian Immigration Committee.

5.—REGISTRATION OF SERVANTS.

The SECRETARY says the Government, the Commissioner of Police and all the Chambers of Commerce had been written to. He has received only an acknowledgment from the Government, none at all from the Commissioner of Police, or from any of the Chambers of Commerce excepting the Federated Malay States Chamber of Commerce which does not think the question comes within the scope of their activities.

6.—RUBBER EXHIBITION.

At the request of Messrs. Jeavons and Carter, with whom I was associated in representing the Association at the Fifth International Exhibition of Rubber and other tropical products, held at the Agricultural Hall from 3rd-17th June, I have gladly undertaken to write a report; or, as I should prefer to call it, a few notes, on exhibits most likely to be of interest to your Members.

MALAYAN SECTION.

Notwithstanding that British Malaya was the last of the Countries or States exhibiting, definitely to book space, the position allotted to us was excellent and the area ample for our requirements. The Federated Malay States Agricultural Department occupied about one-third of the space with their cleverly prepared but rather grim exhibit of the effects of the various diseases of the rubber tree. The remaining two-thirds of the stand was occupied by a very fairly representative assortment of our rubber in bulk.

Mr. Leonard Wray, I.S.O., at the request of the Malay States Agency, and the Rubber Growers' Association again did the unpacking and arranging of the exhibits, thereafter spending every day on the stand, answering questions, wise and foolish, with equal patience.

We welcomed a considerable number of visitors including the Lord Mayor and Sheriffs, but the more picturesque show put up by our Ceylon neighbours, with its greater variety of tropical products certainly attracted greater attention.

Ceylon had the advantage of a longer start in collecting and preparing exhibits because they had earlier advice of their Government's intention to support them.

The generous intentions of the Federated Malay States and Straits Governments, on the other hand, were communicated so late in the day to those immediately concerned, that their precious cash nearly shared the fate of the luggage of the absent-minded traveller described in the Hunting of the Snark:

> He had forty two boxes all carefully packed
> With his name printed clearly on each,
> But since he omitted to mention the fact
> They were all left behind on the beach.

The competition samples were exhibited in the gallery where they were judged by the London Arbitration Committee, consisting of six brokers and four dealers. Mr. Oliphant Devitt of the firm of Lewis and Peat did yeoman service in arranging and labelling the samples.

COMPETITIONS.

The Awards in the competition open to British Malaya were as follows:

COMPETITION No. 1.

FOR BEST COMMERCIAL SAMPLES OF PLANTATION RUBBER.

MALAYA SECTION.

AWARD.	PRESENTED TO
Rubber Growers' Association Gold Medal and Cup presented by Mr. Noel Trotter	Nordanal (Johore) Rubber Estates Nordanal Estate, Johore, Malay Peninsula. Medal presented to the: Nordanal (Johore) Rubber Estates, and Cup presented to: Mr. T. C. Hume, Manager of the Nordanal Estate.
Rubber Growers' Association Silver Medal and Cash price of £15	Kepong (Malay) Rubber Estates, Ltd. Kepong Estate, Kuala Lumpur, F.M.S. Medal presented to the: Kepong (Malay) Rubber Estates, Ltd., and Cash prize to: Mr. W. Dunbar Fraser, Manager of the Kepong Estate.
Rubber Growers' Association Silver Medal and Cash price of £15	Sungei Kapar Rubber Co. Ltd., Sungei Kapar Estates, Kapar. F.M.S. Medal presented to the: Sungei Kapar Rubber Co. Ltd., and Cash prize to: Mr. H. R. Jones, Manager of the Sungei Kapar Estate.
Rubber Growers' Association Bronze Medal and Cash price of £10	Labu (F.M.S.) Rubber Co. Ltd., Labu Estate, Negri Sembilan, F.M.S. Medal presented to the: Labu (F.M.S.) Rubber Co. Ltd., and Cash Prize to: Mr. G. B. W. Gray, Manager of the Labu Estate.
Rubber Growers' Association Diploma	Straits Rubber Co. Ltd., Gedong Estate, Province Wellesley, S.S.
Special prize for Scrap Rubber Presented by Mr. Cyril Baxendale Silver Rose Bowl	Telok (F.M.S.) Rubber Co. Ltd., Telok Estate, Klang, F.M.S. Prize to be presented to: The Factory Superintendent.

THE FOLLOWING AWARDS WERE MADE IN CONNECTION WITH EXHIBITS IN THE MALAYAN STAND.

MALAYA.

AWARD.	PRESENTED TO
Rubber Growers' Association Diploma	Cicely Estate for No. 1. Crepe. Kent „ „ „ 1. „ Kepong „ „ „ 1. „ Tebrau „ „ „ 1. „
Rubber Growers' Association Diploma	Alma Estate for Ribbed Smoked Sheet.
Rubber Growers' Association Diploma	Carrotina Estate for Smoked Sheet Mount Austin Estate for Smoked Sheet. Nordanal Estate for Smoked Sheet. Selangor „ „ „ „
Rubber Growers' Association Diploma	Caledonia Estate for Light Brown Crepe.
Rubber Growers' Association Diploma	Jugra Estate for exhibit of Scrap Grades.
Rubber Growers' Association Diploma	Nordanal Estate for Compo Crepe.
Rubber Growers' Association Diploma	Tan Kah Kee & Co. for exhibits of Blanket Crepes and other Grades.
Rubber Growers' Association Diploma	Department of Agriculture, F.M.S. and S.S. for Mycological exhibit.

NEW USES.

It must be confessed that most of us interested in rubber, were extremely disappointed at the inability of the judges of the "New Uses Competition," for the £5,000 worth of prizes offered by the Rubber Growers' Association, to announce their awards in time for the exhibition. It is rumoured that of the two thousand ideas submitted there are many which are not new, and also many which are not suitable for practical application; but there are doubtless a goodly number which will prove valuable. However, the judges were doubtless well advised not to allow themselves to be driven into premature decision, as it is said, they are submitting some of the most hopeful to practical tests.

THE PEACHEY PROCESS CO., LTD.

The novelty which excited the greatest interest of the experts was shown by the above.

Late in 1918, Mr. J. S. Peachey discovered that when rubber, or a compound containing rubber, is exposed alternately to the action of sulphur dioxide and of hydrogen sulphide, these two gases diffuse into the material and interacting therein, with the liberation of nascent sulphur, bring about a rapid and perfect vulcanization without the aid of heat.

Apart from its obvious advantage in removing some of the burden borne by the overworked and underpaid coal miner (?), it is claimed for this process that it is possible to introduce into the rubber a large number of new colouring matters and what is perhaps of even more importance, organic material—e.g., leather waste, wood meal, coal dust, cellulose, etc., which decomposed or partly decomposed by the high temperature of ordinary vulcanization can by the new method, be compounded with rubber, yielding cheap products with new properties and exceptional durability.

This was the first exhibition of the work that Mr. Peachey has been engaged upon since he first hit upon the discovery 2½ years ago and the result was made attractive to women as well as to men by the inclusion of many fabrics of beautiful colours. As a mere man, the writer saw the greatest possibilities in the leather samples. The wastage in the manufacture of leather goods is very considerable, and the manufacturers are glad to dispose of the leather clippings at a nominal price (say) one pound sterling a ton. Mixed with 20 per cent to 30 per cent of rubber it is claimed that a substance which actually *is* leather, *not* a leather substitute, is reconstituted, with the added advantage of being waterproof. In addition to most of the ordinary mechanical goods, the Peachey Process appears to open up a number of new fields for the use of rubber; while the absence of heat indicates the possibility of eliminating one of the heaviest items in manufacturing costs.

The Peachey Process Co., Ltd., was formed in August, 1920. Research laboratories have been equipped and a model works established at Willesden. The Company is now in a position to grant licenses for the use of the Process in the United Kingdom and in other countries.

Amongst the many visitors whom the writer personally introduced to Mr. Peachey was a gentleman whom he regards as one of, if not the greatest of living inventors. This gentleman is already in negotiation for manufacture under the patent. Other members of the Exhibition Executive appeared equally interested. The stand was constantly crowded with visitors. The Rubber Growers' Association's diploma was awarded for the general exhibit.

Paraflor.

This rubber carpeting was introduced by the North British Rubber Company and proved an attractive feature of the Malaya stand which was entirely carpeted with it. Sold at little more than the cost of linoleum, it is claimed for it to be practically indestructible and everlasting. While extremely flexible it does not curl, its own weight being sufficient to keep it flat. It is resilient and velvety to the tread and there is no canvas to rot. The Rubber Growers' Association awarded a diploma to the North British Co. for this exhibit.

Onazote Limited.

This Company exhibited numerous specimens of their successful expansion of rubber by gas. The exact results of the tests of these properties have been obtained by the assistance of the National Physical Laboratory and were given for the first time at this exhibition. Beautiful girls in the scantiest of bathing dresses, were shown disporting themselves on rubber rafts which it is claimed are six times as buoyant as a raft of cork of the same weight. Orders for rafts have been placed which are to be supplied as soon as they can be manufactured. It should perhaps be mentioned that the girls are made of porcelain.

Rubber Roadways Limited.

The work of the Company was fully described in the special exhibition number of the Rubber Growers' Association Bulletin. Unfortunately, the distribution of this issue at the exhibition was supressed by an *ex-parte* injunction, obtained by Mr. Dessau a gentleman associated with the Company at the commencement of their undertakings and who was awarded the Rubber Growers' Association Gold Medal in 1914. As up to the present the case is not finished—a cross action—between Mr. Dessau and the Association, it would be advisable to confine one's remarks to a statement made by the Chairman of Rubber Roadways Limited at the Conference, to the effect that the cost amounted to £4.16.0 a yard and that the Company would welcome suggestions for a more economical system. The cost of the raw material obviously has little bearing on the cost of the roadway. The preparation of the foundation of the road and of labour in manufacturing the rubber blocks, and connections are the main consideration.

On the other hand, rubber flooring has made considerable progress thanks, no doubt, to the example set by the Rubber Gifts Fund which has presented flooring to a number of hospitals in London and the Provinces. The Rubber Growers' Association are now able to quote the names of upwards of 80 hotels, banks, stores and offices which have adopted the clean, noiseless and in the long run, economical floor covering.

Davidson's Process.

Messrs. Davidson and Company occupied a stand where they gave practical demonstration of their system of treating latex preserved in a fluid state by Siroxidine. By the use of this preservative, latex can be kept in a fluid state indefinitely; some of the samples used in demonstration having been collected several years ago. It is claimed that latex so treated coagulates more rapidly and completely than does untreated latex, when coagulated in the ordinary way at the estate factory. Several days' collection can be kept in a fluid state, if it is inconvenient to run the machines daily. The subsequent treatment is said to obviate the

necessity of drying or smoking. As regards these latter advantages we must hear what the manufacturers have to say although there is no reason to suppose that they will regard it unfavourably; yet it must be recognized that these gentry are inclined to be shy of adopting innovations. It is understood that attempts are being made to secure their friendly co-operation.

Scientific.

In addition to the exhibits of the Federated Malay States Agricultural Department, there was an interesting section in the Rubber Growers' Association Gallery, devoted mainly to the diseases of the rubber tree. Mr. A. R. Sanderson, F.L.S., was in regular attendance in this section. The Imperial College of Science and Technology of London, was also well represented, visitors being invited to see the various stages of Brown Bast development through microscopes. This section was a veritable Chamber of Horrors, but unlike the Wax Works Exhibition, experts were in attendance to advise how to avoid or cure the evil.

Pneumatic floats and other parts of air ships made from rubber were lent by the Silvertown Company, and attracted much attention.

Machinery.

Messrs. M. McKinnon and Company, Limited, who were awarded the French Gold Medal in 1914, again exhibited a fine display of machinery for treating rubber and other tropical products. The writer who had the honour of acting as judge on that occasion, was pleased to notice a distinct advance in the firm's general exhibit.

Messrs. Guthrie and Messrs. Harrisons and Crosfield were awarded the Rubber Growers' Association diplomas for their attractive exhibits. Messrs. Thomas Barlow and Brothers exhibited among other things of general interest, the Senang Folding Machine for packing crêpe. Messrs. Francis Shaw and Company, in conjunction with the Hunter Dry Kiln Company of America, exhibited the Hunter Kiln by the use of which it is claimed that rubber can be rapidly and economically dried without surface oxidation. There were many other stands with tools, machinery and packing requisites of value to the rubber planter, but as the writer did not undertake to write a full report on the exhibition, he hopes the exhibitors will pardon him for leaving them to personally submit their valuable wares to the planting community. It does not necessarily follow that those mentioned are of greater value than those which time and space have forced him to ignore.

General.

Although the word "rubber" took precedence in the title of the exhibition and all rubber producing countries of any consequence gave a good account of themselves, other tropical products predominated. It was particularly gratifying to see the advance made by Brazil in other directions.

A few of the old lumps of fine hard figured at one end of their stand, but these were insignificant compared with their display of beautiful timbers, fruit and nut products, fibres and cigars. France, Belgium, Portugal, the Netherland Indies, the Phillipines, the Gold Coast, and numerous other foreign countries, and British Dominions were richly and picturesquely represented with such a variety of products that the general public found the exhibition of greater interest than any of its predecessors. The average daily attendance was 3,000 during the first week, and well over 6,000 daily the second week. These paid for admission. Many availed themselves of complimentary tickets, and there was a continuous stream of schools admitted free. A continuous free cinema with films, supplied by various Governments and Industrial Companies, showing development work in all parts of the world, was well attended, as were some of the Conferences; although it must be admitted that the more technical, frequently delivered in a foreign language, did not draw a large crowd—this was possibly due to the extreme heat, which prevailed throughout the fortnight.

The writer had the pleasure of representing your Association at the French, Dutch, Portuguese, Malayan, Ceylon, Brazilian and Gold Coast receptions, also at the Press Lunch, and International Banquet. The latter was honoured by the presence of five Ambassadors. Germany and Austria, by the way, were not represented at this exhibition.

Messrs. Carter and Jeavons would assuredly wish to be associated with the writer when he says that the thanks of your Association are particularly due to Mr. Leonard Wray, who again did the lion's share of the work for Malaya. Captain Carter, unfortunately, on the second day contracted a chill which developed into pneumonia. Mr. Jeavons lived too far away to spend much time at the Agricultural Hall. The writer, was in attendance on two days before and twelve days after the opening; but his duties on the Exhibition Executive took up most of his time, and but for the devotion of Mr. Wray to the post of duty, our stand would have frequently been left to the care of the Commissioners.

As an organiser of rubber exhibitions, it was agreed that Mr. Greville Montgomery had proved himself a worthy successor to the late Mr. Staines Manders.

A few of us were invited to a private luncheon with Mr. Montgomery two days before the exhibition closed, and asked to express our opinion as to whether it had been a success, and if another was desired, to advise where and when it should be held.

As the locality and date are still under consideration, the writer will confine himself to saying that every member of the party agreed as to the success, and spoke in favour of another being held a few years hence.

In conclusion, the writer must express his sense of the honour conferred by your Association in again inviting him to assist in representing British Malaya. He is as proud of this as he is of being the "Doyen" of the Exhibition Executive.

On the motion of Mr. Cumming, votes of thanks are accorded to Messrs. Clyde Jeavons and Carter for their labour on behalf of the Association and especially to Mr. Wray for his services as Commissioner and to Mr. Baxendale for his lucid and interesting report.

7.—RESTRICTION.

The Secretary says that at a public meeting held on 19th July the Standing Committee was asked to form a Restriction Propaganda Committee under the terms of a resolution passed at the meeting. The Committee had been formed and had already held its first meeting, and decided on a course of action. By the last mail he had received the following particulars relating to the Rubber Growers' Association Rubber Producers' Corporation, Limited:

The Rubber Growers' Association.
(Incorporated.)
38, Eastcheap,
London, E.C., 3,
15th July, 1921.

To all Producers of Plantation Rubber.

Ever since it became apparent that grave difficulties were impending in the Rubber Plantation industry the Council of the Rubber Growers' Association have been engaged in the earnest consideration of schemes to meet the situation. As an immediate step, the Council recommended a restriction by 25 per cent. of the normal production of rubber from 1st November, 1920, and this proposal was accepted and carried out by over 90 per cent. of the Association's membership, but it has not received from non-members of the Association the support necessary to make it really effective.

Since that restriction came into effect the situation has become even more critical, yet over-production has continued.

It must be borne in mind that about one-third of the acreage of rubber planted in Malaya is owned by Chinese and Malays, the latter almost entirely in small holdings. Any idea of voluntary restriction is beyond them, but as they are nevertheless suffering acutely through the depression in the industry, the Association readily supported a request for the assistance of Government to impose some form of compulsory restriction of output or export

on all producers in British Malaya. After much delay the Government declined to render any assistance in that direction, leaving the industry to work out its own salvation.

The war has been responsible for completely upsetting the calculations of those interested in the Plantation Rubber Industry, whether as producers or consumers.

Approximately 70 per cent. of all the rubber consumed in recent years has gone into tyres. War requirements accelerated the development of motor transport, and the post-war boom led everyone, including the manufacturers, to believe that the peace requirements of the world were greater than has proved to be the case. Vehicles used for military purposes consumed tyres at an altogether abnormal rate when contrasted with what would be consumed by the same number of vehicles on ordinary civilian work. Furthermore, considerable improvements have been made in the construction of tyres in recent years, particularly in the development of the so-called 'Cord Tyre,' from which a much greater mileage is obtained than from the ordinary fabric tyre. The importance of these improvements is obvious when considering the possible consumption of rubber during the next few years.

There are, of course, new uses to which rubber is being put, but the amount so absorbed does not appear to be likely to increase materially the consumption in the immediate future. Every new idea has to be put to protracted tests and requires new machinery before production can commence on a large scale.

The stabilising of the price of rubber would undoubtedly be beneficial in expediting developments, as manufacturers would then be able to lay their plans with greater confidence than is possible when their raw material is subject to violent fluctuations.

It is advisable to recall that in 1914 the total rubber production of the world was 126,000 tons, of which some 77,000 tons were plantation and 49,000 tons wild rubber. Unrestricted production in 1921 would amount to about 360,000 tons of plantation and 30,000 tons of wild rubber, and the existing plantations alone are capable of yielding at the rate of 500,000 tons per annum within a comparatively short time. Notwithstanding the voluntary restriction agreed to in response to the Council's circular of 24th September, 1920, stocks of raw rubber in London and Liverpool have increased from 56,000 tons at 1st January, 1921, to 79,000 tons at the end of June, 1921. The present world stocks of rubber are estimated to be about 300,000 tons, which figure includes all rubber on estates, in transit to and at port of shipment, afloat, in warehouse at ports of arrival, in consuming countries, and in the hands of manufacturers. The stocks necessary for the normal working of the industry may be taken as seven months' consumption, and at the present rate of consumption (20,000 tons a month) are about 150,000 tons. There would thus appear to be 150,000 tons of surplus rubber in existence.

The Council consider that, as no material relief can be looked for through early expansion in demand, producers are faced with the alternatives of—

(*a*) Continuing to produce more rubber than is being consumed, thus adding to the surplus stocks depressing the price still further, and bringing disaster to a large section of the industry; or

(*b*) Combining

(i) to regulate production to the extent necessary to ensure surplus stocks being absorbed and thereafter to keep pace with the requirements of manufacturers, and

(ii) to regulate the sale of rubber, having first obtained the necessary financial support to do this effectively.

With regard to the whole question of combination and control, the principal factors to keep in mind are:

(1) The existing world stocks of 300,000 tons.

(2) The potential 1922 output of over 400,000 tons.

(3) The potential 1922 consumption, which is unlikely to exceed 250,000 tons.

(4) The labour situation in the producing countries.

(5) The vitality of the rubber tree which, after reaching maturity, remains a potential source of rubber, even though upkeep is entirely neglected.

The accompanying scheme outlines what is believed to be a practicable method of achieving the desired rehabilitation of this great industry, but the task of securing the adhesion of 2,200,000 acres (about two-thirds of the existing planted area), the minimum deemed necessary to make the scheme effective, can only be accomplished in a spirit of co-operation. In arriving at this figure it is anticipated that no substantial acreage of native holdings can be brought into the Corporation. Owing to excessive tapping in the past the major portion of these holdings acre for acre is inferior in yielding power to the European-owned Estates, whilst their product is primitively prepared and not of standard quality. Only about one-half of the 2,200,000 acres is controlled in the United Kingdom, and the co-operation of the Dutch interests and of the principal local producers in the various Eastern countries is essential.

The Council have kept in close touch with the Producers' organisations in other countries, and it is certain that there is now a nearer approach to unanimity than ever before in regard to the measures necessary to meet the situation.

Producers are asked to bear in mind that restriction alone can only be a temporary palliative. If restriction is left to the individual producer no stabilization would be possible, for as soon as the price rose to a profitable level again there would be a scramble for labour and over-production would again ensue, with a consequent slump in prices. An appeal is made to all producers

to refrain from entering into further forward contracts as these must greatly prejudice the possibility of successfully establishing the Corporation.

The Council of the Association urge all producers to give the scheme for the formation of the "Rubber Producers' Corporation" their whole-hearted support.

Members of the Output Control Committee will gladly explain the scheme personally and appointments for this purpose can be made at the office of the Association.

A form of provisional assent is appended, which should be returned to me with the least possible delay.

FRANK G. SMITH,
Secretary.

PROVISIONAL ASSENT.

TO THE COUNCIL,
RUBBER GROWERS' ASSOCIATION (INC.),
38, EASTCHEAP, LONDON, E.C. 3.

I/We agree that in event of a "Rubber Producers' Corporation" being formed as nearly as possible on the basis of the scheme accompanying your Circular dated 15th July, 1921, I/We are prepared to become members thereof in respect of the below-mentioned acreage, subject to the scheme in its final form meeting with our approval.

(Signed).....

.....

.....

Total area planted or interplanted with rubber.

.....acres.

Scheme referred to in Circular issued by the Rubber Growers' Association (Inc.), dated 15th July, 1921.

This is not a Prospectus and no applications will be received except on terms to be subsequently announced.

THE RUBBER PRODUCERS' CORPORATION, LIMITED.

1.—PRIMARY OBJECTS OF THE CORPORATION:

(*a*) To control the rubber output of its Members;

(*b*) To fix the selling price and regulate the sale of the rubber produced by its Members;

(*c*) To regulate the opening of further rubber lands by its Members;

(*d*) To purchase or make advances on the rubber harvested or to be harvested by its Members;

(*e*) If deemed desirable to make advances on security and on terms to be agreed to approved rubber estates belonging to its Members.

The Corporation will not exercise any functions in regard to the management or control of estates belonging to its Members except in regard to the matters referred to in this clause.

2.—Capital:

Nominal Capital £2,000,000, in 2,000,000 shares of £1 each. Borrowing powers up to an amount of £8,000,000, either by Debentures or otherwise, of which a minimum of £3,000,000 is to be raised in the first instance.

It is proposed to allot the Ordinary Shares to Rubber Plantation Companies or individuals owning plantations, upon joining the Corporation, in the ratio of one share for each planted acre of rubber they possess, in consideration of their entering into agreements binding the holders to conform to such conditions and regulations as the Corporation may impose with a view to carrying out the above objects, and of their subscribing for these shares as follows:

For every acre of mature rubber	2*s*. 6*d*. per share on application. 2*s*. 6*d*. ,, 3 months after allotment. 2*s*. 6*d*. per share 6 months after allotment. 2*s*. 6*d*. per share 9 months after allotment.
For every acre of immature rubber	2*s*. 6*d*. per share on application. 2*s*. 6*d*. ,, 6 months after allotment. 5*s*. 0*d*. per share when the acreage in respect of which such shares are allotted reaches maturity.

It is anticipated that it will not be necessary to call up the balance on the shares.

It is proposed that the Corporation shall include estates owned by British Companies and individuals wherever situated and by Companies or individuals in British Territory or Protectorates, whilst a similar Corporation is to be formed simultaneously to include estates owned by Dutch interests and by Companies or individuals in the Netherlands East Indies. A working agreement would then be entered into by the two Corporations to ensure conformity of action.

The agreements to be entered into between the Corporation and its shareholders and between the Corporation and the Dutch Corporation shall be for a first period of five years or until a resolution for the voluntary winding up of the Corporation is passed at a Meeting of shareholders at which 75 per cent. of the capital is represented.

The Corporation will not go to allotment until the owners of at least 2,200,000 acres, inclusive of the Dutch Corporation Membership, have agreed to come into the scheme.

3.—Debentures:

It is an essential part of the scheme that either:

(*a*) The subscription of £3,000,000 of Debentures shall be guaranteed before the Corporation is actually registered: or

(*b*) Satisfactory arrangements must have been made for finance to the extent of at least £3,000,000, in addition to the Share Capital.

Any Member of the Corporation may subscribe to any Debenture issue which may be made, but this is not obligatory.

4.—The Articles of Association of the Corporation will provide for:

(*a*) Transfer of shares to be effected only on a transfer of the relative estates;

(*b*) The introduction of new Members from time to time on terms to be fixed by the Court of Directors;

(*c*) Enforcing the performance of the contracts and conditions entered into by shareholders with the Corporation.

5.—Management:

Court of Directors.—The Control of the Corporation's affairs shall be in the hands of a Court of Directors (approximately one Director to every 100,000 acres) representing as follows:

London Companies and Proprietors owning Estates in Malaya ...	6	Directors.
London Companies and Proprietors owning Estates in Ceylon ...	2	,,
London Companies and Proprietors owning Estates in Borneo ...	1	,,
London Companies and Proprietors owning Estates in Sumatra ...	2	,,
London Companies and Proprietors owning Estates in Java	2	,,
London Companies and Proprietors owning Estates in India and Burma	1	,,
Ceylon Local Companies and Proprietors	2	,,
Malaya Local Companies and Proprietors	2	,,
	18	,,
Representing Debenture Holders ...	3	,,
Total ...	21	,,

Excepting those representing the Debenture Holders the Directors are to be nominated in the first instance by the Council of the Rubber Growers' Association, who will obtain the

nominations of the Ceylon Local interests and Malaya Local interests of their representatives on the Court. The Directors nominated by the Council shall come up for re-election at the first Ordinary General Meeting and thereafter one-third shall retire annually.

The Directors will as far as practicable be elected by the shareholders grouped according to the countries in which their estates are situated, the local interests being grouped separately from the London interests.

Executive Board.—Four Members of the Court of Directors, of whom one shall be a Director representing Debenture Holders, together with a Manager and a Secretary, shall form the Executive Board of Management for carrying out the instructions of the Court.

The Manager must be a man of the highest business ability and standing, and the Corporation must be prepared to pay on a sufficiently generous scale to secure the best possible man.

The Secretary should be a first-class accountant, capable of organising and controlling the accounts of the Corporation with the utmost efficiency, and should be preferably a fully qualified and experienced chartered accountant.

Joint Advisory Board.—A Joint Advisory Board shall be established to ensure collaboration between the London Corporation and the Dutch Corporation, consisting of three Members nominated by the Directors of each Corporation.

Remuneration.—The remuneration of the Court of Directors shall be fixed by the shareholders in General Meeting. The Court shall fix the remuneration of the Executive Board and of the Joint Advisory Board.

6.—Output and Sales:

(*a*) The output of rubber by Members, including provision for young areas on their reaching maturity, will be regulated equitably by the Court of Directors and may be varied from time to time to meet market conditions.

(*b*) The Court of Directors shall fix from time to time the prices at which the rubber controlled by the Corporation may be sold.

(*c*) On all sales of rubber controlled by the Corporation there shall be paid to the Corporation a sum per pound to be fixed by the Court of Directors, which must be sufficient to enable the Corporation to pay the expenses of management, to pay interest on and to provide a sinking fund for the redemption of Debentures, and to accumulate funds at the credit of its several Members as surety for the due fulfilment of their obligations to the Corporation. If the charge in the first instance be fixed at, say, 1*d.* per lb., it is estimated that the revenue from this source together with interest on advances would yield an annual income which would be sufficient for the purposes indicated. This charge may be increased but shall not exceed 2*d.* per lb., without the consent of a General Meeting.

(*d*) All rubber harvested by Members will be consigned as at present and sold as authorized by the Court of Directors through the usual channels, the brokers being responsible for passing directly to the Corporation the charge before referred to.

(*e*) All forward contracts which existed on the 15th July, 1921, shall be notified to the Corporation on its formation and shall then be duly recognized.

7.—GENERAL:

Members must supply to the Corporation such information as it may call for in regard to the particulars of areas owned by them, the acreage of rubber mature and immature, the age of the trees, the crops harvested in the past, existing stocks, and such other particulars as may be required for the purposes of the Corporation.

Mr. CUMMING is sorry to say that Mr. Duncan has had to leave the country on medical advice. They would remember that the Rubber Restriction Committee had asked Government to appoint an Advisory Committee, the appointment of which had been deferred. The Propaganda Committee had decided to ask the Committee to appoint that Committee in order that it might advise Government on the situation. Mr. Duncan, before he left, had expressed his regret at not being able to be present but as he did not wish to disregard medical advice he had sailed for Home and, had asked Mr. Kindersley and himself to be the intermediaries between the Committee and Government. Mr. Kindersley was well-known to them and undoubtedly enjoyed the full confidence of all members. As far as he himself is concerned he will do his best.

Mr. UTTERSON KELSO inquires whether there were any replies to the cables sent to England.

The SECRETARY says cables have been received from the Rubber Growers' Association.

Mr. SHELTON-AGAR inquires for what purposes the Propaganda Committee was appointed. As far as he could gather the Dutch East Indies were not in favour of the Rubber Growers' Association Rubber Producers' Corporation Scheme. It has not found favour in many quarters in this country and Ceylon too had turned it down.

The SECRETARY reads the following terms of reference to the Committee as decided at the public meeting:

> "The Committee shall formulate and draft a circular in all languages spoken in Malaya to be sent to all rubber producers and cultivators and those who influence the commodity to make an appeal for support of the Rubber Growers' Association Rubber Producers' Corporation, Limited."

Mr. KINDERSLEY says he believes the Committee which the Government was appointing would go into all the schemes and would not confine itself to any scheme. It would be composed of business men and planters and it was such a Committee that was required now.

8.—GENERAL.

(*a*) Mr. Reeve-Tucker believes that the Unemployment Fund is seriously in need of money and he does not understand why the rubber companies, which are mostly responsible for the unemployment should not be approached for monthly subscriptions. These companies were saving hundreds by dismissing these men. He wishes the Standing Committee would take up the matter and ask the Chairman of the Unemployment Committee to canvas these companies, which had created unemployment in the country for subscriptions.

Mr. Cumming says the matter could be dealt with today without being referred to the Standing Committee at all, as it would otherwise cause considerable delay. The matter was an important one and the companies certainly should contribute something if they were in a position to do so. He does not think that companies are trying to save money by dismissing men.

Mr. Reeve-Tucker says his point is that the companies had not been canvassed for subscriptions. If the meeting is with him he wishes to propose the following motion: "That the suggestion be made to the European Unemployment Committee that in order to raise further funds all rubber companies should be canvassed for monthly subscriptions."

Major Slee seconds the motion which is carried *nem dis.*

(*b*) Mr. Furley suggests that the Secretary should write to the Government to find out what it is doing to prevent the profiteering in rice which is now going on.

(*c*) Mr. Bradbery says he wants to bring up a rather serious question. The Standing Committee had gone very carefully into the matter of finance so far as the Planters' Association of Malaya was concerned, and although they had cut down expenses to a minimum the future of the Association was yet not as they wished. Several Associations had withdrawn from the Planters' Association of Malaya and they might find at the end of the year that they will not have enough money to run the association and he therefore wishes to propose that the Standing Committee be asked to go into the question thoroughly of reconstruction or continuation of the Planters' Association of Malaya.

Agreed to.

(*d*) Mr. Gordon Graham asks if anything more has been done with regard to the Bureau of Statistics?

The Secretary understands that not only has the preliminary work of the Rubber Census been started but that the work of the census had actually commenced.

(*e*) The SECRETARY says the Standing Committee had taken up the matter of quit rents and the Government, in reply to a letter, had said that any application for the deferment of collection of quit rents on titles would be considered upon its own merits.

(*f*) The SECRETARY says that at the last meeting the matter of diseases on native holdings was brought up and was referred to the Standing Committee who took it up with Government with the result that the Department of Agriculture had recently sent a circular to all District Planters' Associations with r gard to their proposals to deal with rubber diseases on neglected or abandoned holdings.

The circular reads as follows:

"Under the supervision of officers of the Inspection Division, Department of Agriculture, it is proposed to create a number of temporary posts to be filled by unemployed planters; these officers will be put in charge of pest gangs, and will be allotted districts which they will work regularly through, and when it is found impossible for an owner to carry out control of disease on his property this will be undertaken by Government, and the cost of such treatment recovered from the owner, either at the time of treatment, or at such future date as he may be able to pay. In the event of his being quite unable to bear the expense, this will be met from Government funds.

"In connection with the above scheme, the diseases at present necessitating most attention are Mouldy Rot, and Pink Disease. Three officers have already been appointed and have carried out considerable work on the control of Mouldy Rot in Negri Sembilan and two extra appointments have been sanctioned. A similar appointment has also been made by the Government of Johore.

"Three similar appointments have also been sanctioned to deal with Pink Disease in Ulu Selangor and Southern Perak.

"In addition to these temporary officers the Inspection Division, which has been very understaffed during the past few years has recently been brought up to almost full strength.

"I should be obliged if Managers of Estates in your district would assist this Department by bringing to the notice of the Chief Agricultural Inspector or to that of his Assistant Inspectors and temporary Assistants, any serious outbreak of disease on neglected or abandoned holdings in the vicinity of their Estates."

With a vote of thanks to the Chair, the meeting terminates at 12.30 p.m.

C. WARD-JACKSON,
Secretary.

TABLE I.

Agricultural Acreages, Federated Malay States, 1919 and 1920, excluding Padi and Horticulture, from Estates over 100 acres in extent.

	Selangor.		Perak.		Negri Sembilan.		Pahang.		Total.	
	1919.	1920.	1919.	1920.	1919.	1920.	1919.	1920.	1919.	1920.
Coconuts	28,311	29,569	38,393	38,781	1,528	1,027	2,780	2,772	71,012	72,149
Rubber	287,008	296,868	234,368	247,058	193,148	208,602	22,218	26,642	736,742	779,170
Coffee	2,237	1,997	642	347	9	...	35	20	2,923	2,364
Other Cultivations	2,780	5,371	2,507	179	3,424	157	504	405	9,215	6,112
Total ...	320,336	333,805	275,910	286,365	198,109	209,786	25,537	29,839	819,892	859,795

TABLE II.

Agricultural Acreages, Malaya, 1920, from Estates over 100 acres in extent.

	Federated Malay States.	Straits Settlements.	Johore.	Kelantan, Kedah and Trengganu.	Grand Total.
Rubber alone	771,525	182,918	178,043	150,569	1,283,055
„ and Coffee	1,334	...	...	170	1,504
„ „ Coconuts	893	307	...	60	1,260
„ with Other Crops	5,418	3,154	1,573	7,354	17,499
Total ...	779,170	186,379	179,616	158,153	1,303,318
Coconuts alone	68,397	24,276	2,244	13,628	108,545
„ and Coffee	660	...	...	...	660
„ with Other Crops exclusive of Coffee	3,092	137	...	...	3,229
Total ...	72,149	24,413	2,244	13,628	112,434
Coffee alone	370	...	...	...	370
„ with Other Crops	1,994	...	...	...	1,994
Total ...	2,364	...	...	...	2,364

TABLE III.

Rubber Statistics, Federated Malay States, up to 31st December, 1919 and 1920, from Estates over 100 acres in extent.

	Selangor.		Perak.		Negri Sembilan.		Pahang.		Total.	
	1919.	1920.	1919.	1920.	1919.	1920.	1919.	1920.	1919.	1920.
No. of Estates	415	431	413	424	330	332	63	80	1,221	1,267
Acreage in possession	426,620	435,272	382,018	387,135	291,126	301,680	67,279	77,602	1,167,043	1,201,689
Acreage planted up to 31st December, 1919 and 1920 ...	287,008	296,868	234,368	247,058	193,148	208,602	22,218	26,642	736,742	779,170
Rubber alone	280,634	293,932	226,672	244,463	187,243	206,809	21,150	26,321	715,699	771,525
Rubber interplanted with catch-crops	6,374	2,936	7,696	2,595	5,905	1,793	1,068	321	21,043	7,645
Acreage producing	205,750	219,511	168,366	175,723	107,786	113,456	8,470	9,258	490,372	517,948
Planted during 1919 and 1920	15,415	9,860	14,887	12,690	27,949	15,454	6,385	4,424	64,636	42,428

TABLE IV.

Rubber Statistics, Malaya, up to 31st December, 1919 and 1920, from Estates over 100 acres in extent.

	Federated Malay States.		Johore.		Kelantan, Kedah and Trengganu.		Straits Settlements.		Total.	
	1919.	1920.	1919.	1920.	1919.	1920.	1919.	1920.	1919.	1920.
No. of Estates	1,221	1,267	149	149	257	270	269	319	1,896	2,005
Acreage in possession ...	1,167,043	1,201,689	364,270	365,426	286,869	328,377	273,353	281,044	2,091,535	2,176,536
Acreage planted up to 31st December, 1919 and 1920	736,742	779,170	174,820	179,616	146,720	158,153	178,524	186,379	1,236,806	1,303,318
Rubber alone	715,699	771,525	171,959	178,043	129,779	150,569	172,191	182,918	1,189,628	1,283,055
Rubber interplanted with catch-crops	21,043	7,645	2,861	1,573	16,941	7,584	6,333	3,461	47,178	20,263
Acreage producing ...	490,372	517,948	96,324	100,683	50,774	54,354	114,516	122,693	751,986	795,678
Planted during 1919 and 1920	64,636	42,428	8,704	4,796	28,488	11,433	6,610	7,855	108,438	66,512

Table V.

Comparative Table of Rubber Crops, Malaya, 1911 to 1920.

State.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.
	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.
Selangor	5,106 14	7,482 6	10,110 15	12,601 6	16,061 11	19,996 11	24,573 3	26,464 11	29,657 6	31,947 6
Perak	2,697 4	4,116 18	6,623 17	8,959 7	12,112 1	17,336 18	19,453 2	21,331 18	25,231 11	27,129 7
Negri Sembilan ...	1,918 12	2,518 16	3,339 16	4,203 18	8,138 1	8,596 14	12,223 3	13,542 4	17,504 2	18,555 4
Pahang	13 18	74 14	155 9	337 19	548 13	682 8	1,010 13	1,179 3	1,292 6	1,512 14
Johore	404 2	968 6	1,645 7	2,861 7	4,711 2	6,840 7	8,193 7	11,267 12	12,426 18	13,358 10
Kelantan, Kedah and Trengganu...	23 0	79 6	246 18	1,383 18	1,955 0	3,704 19	4,729 2	5,568 6	6,719 16	7,713 0
Malacca	382 11	1,742 6	3,549 2	3,979 16	5,181 1	6,606 12	7,376 16	7,721 19	8,016 0	9,079 5
Province Wellesley*	571 15	1,973 16	2,498 12	3,076 8	3,177 11	3,912 11	4,760 1	5,203 15	5,910 0	6,413 15
Total ...	11,117 16	18,956 8	28,169 16	37,403 19	51,885 0	67,677 0	82,319 7	92,279 8	106,757 19	115,709 1

* Including Singapore, Penang, and Dindings.

TABLE VI.

** Estate Labour, Federated Malay States, 1920, from Estates over 100 acres in extent.*

—	Selangor.	Perak.	Negri Sembilan.	Pahang.	Total.
Tamil men	50,978	46,028	14,465	1,518	112,989
„ women	22,104	18,341	4,028	289	44,762
„ children	9,166	6,803	1,549	127	17,645
Javanese men	1,330	1,629	852	1,593	5,404
„ women	276	753	211	876	2,216
Malays	1,054	2,655	1,178	638	5,525
Chinese	7,947	6,301	10,609	1,716	26,573
Others	186	295	538	75	1,094
Total ...	93,041	82,805	33,430	6,932	216,208

* Coolies working under contractors are not included.

Table VII.

** Estate Labour, Malaya, 1920, from estates over 100 acres in extent.*

	Federated Malay States.	Johore.	Kelantan, Kedah and Trengganu	Straits Settlements.	Total.
Tamil men	112,989	9,075	13,016	18,928	154,008
„ women	44,762	1,906	6,060	7,060	59,788
„ children	17,645	482	1,844	2,278	22,249
Javanese men	5,404	4,574	924	2,429	13,331
„ women	2,216	976	163	760	4,115
Malays	5,525	3,954	7,380	3,802	20,661
Chinese	26,573	8,297	10,058	6,722	51,650
Others	1,094	501	464	157	2,216
Total ...	216,208	29,765	39,909	42,136	328,018

* Coolies working under contractors are not included.

Abstract of Meteorological Readings in the various Districts of Malaya for the month of July, 1921.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru ...	...	147.0	81.8	90.45	74.19	16.25	76.9	.829	73.6	76.	...	7.00	1.63
Pahang, Kuala Lipis	...	...	81.34	88.93	75.41	13.52	76.27	...	...	...	...	6.46	.98
Johore, Johore Bahru	...	...	...	87.41	73.90	13.51	...	...	...	...	...	7.60	4.22
Singapore, Kandang Kerbau ...	1014.3	...	82.6	85.0	77.9	7.1	76.2	.937	...	80.	Calm	6.13	2.45
Malacca, Durian Daun ...	1017.7	135.0	82.0	87.0	73.0	14.0	77.0	.906	...	80.	N.E.	5.03	1.18
Negri Sembilan, Seremban ...	...	153.7	81.9	87.5	75.1	12.4	75.6	.785	71.7	72.5	N.W.	2.62	1.22
,, Kuala Pilah ...	...	159.9	79.2	91.3	...	...	80.0	.966	77.8	86.7	...	5.44	1.85
,, Port Dickson	...	115.1	80.4	88.5	74.0	14.5	77.8	.866	77.1	79.7	...	8.12	1.96
Selangor, Kuala Lumpur ...	...	...	81.8	90.0	71.6	18.4	77.6	.869	74.7	79.	S.E.	5.89	1.75
,, Klang	...	...	84.7	86.7	74.5	12.2	77.1	...	...	...	...	.85	.62
,, Kuala Selangor ...	...	...	...	90.5	71.7	18.8	...	...	...	...	...	1.37	.55
,, Rawang	...	...	...	89.8	78.8	11.0	...	...	...	...	...	3.61	1.03
Perak, Telok Anson	...	...	83.39	92.0	71.0	21.0	78.22	.898	...	79.	...	1.85	.55
,, Ipoh	...	...	82.31	95.0	70.0	25.0	76.68	.842	75.0	77.	...	3.76	1.65
,, Taiping	...	111.0	82.91	93.0	72.0	21.0	79.25	.950	...	85.	...	8.03	2.04
,, The Cottage	...	...	83.21	93.0	72.0	21.0	78.05	.892	...	79.	...	3.76	1.29
,, Parit Buntar	...	...	...	...	...	...	...	...	...	...	...	11.81	1.73
Penang, George Town	1008.2	152.0	82.3	92.0	69.0	23.0	78.0	.900	71.3	81.5	S.	3.50	2.32
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	8.82	1.45
Perlis, Kangar	...	...	...	88.06	73.87	14.19	...	...	...	...	...	7.15	1.82

Abstract of Meteorological Readings in the various Districts of Malaya for the month of August, 1921.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	144.5	82.2	91.03	91.03	17.16	76.4	.799	72.5	72.	...	3.47	0.70
Pahang, Kuala Lipis	...	...	80.48	88.80	74.87	13.93	75.53	...	...	...	...	5.71	1.55
Johore, Johore Bahru	...	...	...	88.22	73.53	14.69	...	...	...	...	...	5.32	1.51
Singapore, Kandang Kerbau ...	1004.6	...	81.8	85.0	78.4	6.6	77.9	.882	...	79.	Calm	5.21	1.77
Malacca, Durian Daun	1017.7	139.0	81.0	87.0	73.0	14.0	78.	.898	...	83.	N.E.	9.01	2.02
Negri Sembilan, Seremban ...	...	157.09	81.1	89.	71.7	17.3	77.2	.851	74.3	80.5	N.W.	5.23	1.65
„ Kuala Pilah ...	...	157.4	82.1	91.3	...	...	79.9	.881	75.3	81.0	...	1.99	.94
„ Port Dickson	...	109.7	82.3	88.7	74.1	14.6	74.6	.873	75.2	79.2	...	7.67	1.87
Selangor, Kuala Lumpur ...	...	...	81.1	89.7	71.4	18.3	76.9	.848	74.3	79.	S.E.	8.17	2.14
„ Klang	...	...	80.8	86.3	74.6	11.7	76.6	...	...	...	...	7.17	2.42
„ Kuala Selangor ...	...	...	...	90.3	72.7	17.6	...	...	...	...	...	2.87	1.25
„ Rawang	...	...	...	90.1	79.1	11.0	...	...	...	...	...	2.37	.81
Perak, Telok Anson	...	...	82.61	94.0	70.0	24.0	77.59	.877	...	79.	...	6.61	1.65
„ Ipoh	...	...	82.40	95.0	70.0	25.0	76.55	.837	74.0	77.	...	3.85	1.25
„ Taiping	...	110.0	81.58	93.0	72.0	21.0	78.43	.931	..	87.	...	9.29	1.37
„ The Cottage	...	...	...	...	...	...	...	...	...	...	...	27.63	3.97
„ Parit Buntar	...	...	82.40	92.0	70.0	22.0	77.54	.880	...	81.	...	5.55	2.67
Penang, George Town	1009.6	152.	79.1	92.0	70.0	22.0	77.0	.915	71.9	82.8	S.	15.47	3.68
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	16.46	2.75
Perlis, Kangar	...	...	...	89.90	73.58	14.32	...	...	...	...	...	9.73	3.39

Abstract of Meteorological Readings in the various Districts of Malaya for the month of September, 1921.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	150.56	81.1	89.7	73.4	16.3	75.7	.785	72.0	74.	...	12.26	1.75
Pahang, Kuala Lipis	...	...	80.53	88.0	74.93	13.07	75.87	...	...	...	...	7.10	1.58
Johore, Johore Bahru	...	...	...	86.60	73.60	13.0	...	...	...	...	...	8.55	3.71
Singapore, Kandang Kerbau ...	1015.8	...	79.9	86.4	77.5	8.9	77.5	.868	...	82.	Calm	8.36	1.53
Malacca, Durian Daun	1017.9	129.0	80.0	86.0	73.0	13.0	77.0	.896	...	83.	N.E.	10.55	2.30
Negri Sembilan, Seremban ...	...	153.0	79.8	89.0	71.6	17.4	75.7	.819	73.1	81.6	N.W.	5.76	1.10
,, Kuala Pilah ...	...	157.2	81.4	89.7	...	...	77.3	.856	74.5	80.3	...	4.69	.91
,, Port Dickson	...	116.5	82.6	87.4	73.3	14.1	77.3	.866	74.8	82.1	...	13.19	3.55
Selangor, Kuala Lumpur ...	...	111.63	82.3	90.3	70.8	19.5	76.7	.811	72.8	73.	S.E.	7.43	1.25
,, Klang	...	...	80.2	84.2	73.9	10.3	76.9	...	...	...	...	6.91	1.10
,, Kuala Selangor ...	...	...	...	90.0	70.0	20.0	...	...	...	...	...	8.32	2.63
,, Rawang	...	...	...	89.2	...	...	...	...	...	...	...	13.75	3.93
Perak, Telok Anson	...	...	81.63	91.0	71.0	20.0	77.41	.885	...	83.	...	6.72	1.76
,, Ipoh	...	...	80.48	93.0	71.0	22.0	76.27	.849	73.95	82.	...	5.69	1.41
,, Taiping	...	112.0	80.87	92.0	71.0	21.0	76.86	.869	...	82.	...	7.73	1.96
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	34.96	2.99
,, Parit Buntar	...	...	81.01	92.0	70.0	22.0	76.76	.864	...	82.	...	13.89	2.16
Penang, George Town	1008.2	135.6	79.2	81.2	71.3	21.0	76.2	.877	87.9	...	N.W.	24.60	4.29
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	23.13	4.20
Perlis, Kangar	...	...	...	...	...	...	...	...	...	...	...	...	...